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**New Patterns of Collaboration and Rivalry in the US and
European Defense and Aerospace Industries**

19 August 2009

by

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Abstract

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In this discussion, we focus more on defense firms—considering the organization of Boeing 787 development and production, the KC-45 aerial tanker competition, and European defense firms' direct investment in the US defense market. In the 787 case, we observe that even experienced companies such as Boeing can run afoul of the complexities of coordinating a multiform venture.

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Keywords: international defense marketplace, Boeing 787, the KC-45 aerial tanker, foreign direct investment

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Disclaimer: The views represented in this report are those of the author and do not reflect the official policy position of the Navy, the Department of Defense, or the Federal Government.

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Section I. Introduction

This report continues a line of inquiry discussed in Franck, Lewis, and Udis (2008). We're interested in analyzing recent developments in the defense industrial base as an international system. We have also focused primarily on North American (primarily the United States) and Europe (primarily the EU). While there is considerable defense industrial expertise and capacity outside those regions, these areas contain most of the major players in the world's defense trading system. Hence, our focus (so far) has been predominantly on the US and the EU.

While we chose the US and EU to make our research task somewhat manageable, an international focus on defense industry is appropriate. For some time, defense industries have been getting increasingly globalized—reflecting an increasingly interconnected world economy. However, globalized defense production poses special problems for those involved. Capability to provide for national security is rightly regarded as a core competency of the nation-state, and dependence upon foreign suppliers, who might become indifferent or hostile, is a continual problem for nations participating in the global defense market.

Accordingly, the national strategies for coping with this dilemma are a major force shaping international commerce in defense. Our previous report, for example, discusses the UK's Defense Industrial Strategy as a serious and thoughtful effort to deal with this problem (pp. 94-108). Others include various regulations and prohibitions built into US law (and are discussed in Section IV of this report).

Within that context, this report focuses on three recent developments in global defense industries: management of complex and global supply chains, competitive source selection when there are international implications, and direct investment (or merger) as a corporate strategy.

Section II discusses the case of managing a complex, distributed production process designed to produce an aircraft with many innovative features. Our example comes from commercial aerospace, the Boeing 787. However, Boeing's

misadventures in coordinating 787 development and production provide useful insights for the defense industrial sector as well. In particular, it examines the US export control regime as it relates to increasingly globalized defense industries.

Section III continues our discussion of the KC-45 competition.¹ This report takes a US DoD (and Air Force) perspective in considering the effort to start recapitalizing the US aerial refueling fleet—from lease initiative to the recent postponement of the KC-45 source selection process. We believe the events speak for themselves. The KC-45 is a matter of great importance for the United States. It involves acquisition of equipment that is either off-the-shelf or requires a relatively modest development program. Despite the need and despite the technical maturity of the system, the US acquisition process has failed to produce a useful result; in fact, it has failed to produce any result at all. Section III offers a narrative of the KC-X (or KC-45) affair. This section also offers some tentative conclusions and recommendations. Fundamentally, there is reason to believe (pending full airing of the relevant facts) that the US acquisition process is maladapted to doing defense business on a global scale.

Section IV considers, in considerable detail, three major European firms' (BAE, EADS and Finmeccanica) efforts to enter the US market through direct investment. This can take the form of corporate acquisitions or “organic” growth by building production capacity within US borders. Foreign direct investment may also be a useful complement to partnerships with US defense firms.² In particular, Section IV considers obstacles to entering the US defense markets, and various strategies for working around those obstacles.

Finally, Section V offers a summation and some closing thoughts.

¹ Our previous report took an EADS/Airbus-centered view, as we analyzed EADS' KC-30 proposal as an offset, a means of persuading a prospective customer understandably cautious about a foreign supplier, and as a coherent part of an unfolding corporate strategy for EADS. (Franck, Lewis, & Udis, 2008, pp. 108-116.)

² For example, EADS/Airbus and Northrop-Grumman formed a partnership for the KC-30 proposal. The EADS-Airbus proposal included A330 production, and tanker conversion facilities in Alabama.

Section II. Boeing 787: Unprecedented Global Outsourcing of a Commercial Aircraft

Introduction

The Boeing 787 Dreamliner, while a commercial aircraft, is a relevant case study in the context of the globalization of the defense industry. Major defense systems, especially those developed in the US, are often criticized for trying to implement immature, “bleeding edge” technologies and for attempting to integrate multiple examples of these technologies into the same weapon system. Additionally, development time is compressed for budgetary reasons that results in insufficient time, money and personnel to properly develop and integrate subsystems. Typical outcomes are significant cost overruns, cutbacks in capability and in the number of units purchased, or outright cancelation before full-scale manufacturing begins (GAO, 2006, 2008).

During the 1990s, Boeing set new benchmarks with its production of the 777. This mid-sized airliner was the first to clearly demonstrate that a two-engine aircraft could fly long-range routes, particularly over oceans. Additionally, Boeing demonstrated that it could outsource the design and production of major parts of the aircraft, which also used Carbon Fiber Reinforced Plastic (CFRP) for major non-critical subassemblies. Finally, the 777 was the first “paperless” aircraft to be designed entirely using networked computers that enabled concurrent engineering with major suppliers. The key software tool used was CATIA (Computer-Aided Three-Dimensional Information Architecture) developed by France’s Dassault Systèmes (Sabbagh, 1996; Sharma & Bowonder, 2004; Smock, 2007).

The development of the 787, which is expected to enter service in 2009 (Boeing, May 2008) represents a more cautious approach to implementing revolutionary technology than is typical with many military programs but arguably quite radical when compared to Boeing’s traditional methods and its sole major competitor, Airbus. The distinction emerges because Boeing has not only decided

to offer a completely new type of airliner, which for the first time makes extensive use of Carbon Fiber Reinforced Plastic (CFRP) for the fuselage and wings, but has also outsourced production to a degree never before accomplished (Jane's, 2008).³

Accordingly, changing both the underlying technology and resulting performance characteristics of a very complex product and the degree of vertical integration (and resulting criticality of coordination among all members of the 787 supply chain) represent, *in toto*, a significant advance in commercial aircraft production. Boeing has more freedom to operate in leading the production of the 787 than it would when producing military aircraft. However, the challenges of coordination and technology maturity are highly similar to those encountered in the development of advanced weapons systems.

A Major Shift in Commercial Aircraft Design and Production

The 787 has two distinctive new characteristics. First, CFRP represents about half the weight of the aircraft, including the fuselage and wings. This radical increase in the use of composites has never been attempted before in an airliner and represents a major change in the nature of the product.

- Fuel consumption and emissions are reduced by about 20% compared to aircraft using the same engines to fly comparable routes.
- Passengers can benefit from more comfortable higher humidity levels since composites can handle higher humidity than traditional metal alloys.
- Larger windows are possible, and the aircraft can be pressurized to 5,000 feet rather than the usual 8,000 feet, increasing passenger comfort, since the a CFRP fuselage is stronger.

³ The 777, while it represented a significant increase in outsourcing compared to earlier Boeing models, had a design that was really more of an incremental improvement over earlier aircraft, such as the smaller but similar 767. The 777 was manufactured using 12% composites, with the remainder being aluminum and other metal alloys (Moad, 2007).

Airlines are anxious to put fuel-conserving aircraft in service. Global fuel prices are quite high and may well be volatile and uncertain for an extended period of time. Also upcoming national and international regulations will likely limit (or tax) carbon emissions by aircraft, a matter closely associated with fuel consumption. Also, passenger comfort is increasingly important since (at least in the US) flights are increasingly delayed or have more and more “padded” schedules to avoid reporting late flights. Finally, older models of aircraft in the same 210-330 passenger class such as the Boeing 757 and 767 are no longer considered fuel efficient and will start reaching the end of their economic lives when the first deliveries of the Dreamliner begin in 2010 (Wilson, 2008).

Boeing has been rewarded for this innovation by the largest initial order in airliner history: 857 firm orders, plus an undisclosed number of options, by February 25, 2008 (Wilson, 2008; Boeing, 2008; Jane's, 2008). From a marketing perspective, the 787 is an unqualified success, and comparisons can be made with other “game changing” Boeing products such as the 707 (1954), the first commercially successful jet airliner (a development closely related to the US Air Force's KC-135A Stratotanker), and the 747 (1969)—the latter still in production 40 years later as both the 747-400/400F and the 747-8 freighter. The 747 remains the most successful widebody aircraft in history, with possible passenger sales of the latter variant (Boeing, 2008).

Outsourcing, Globalization and the Challenge of Integration

While the 787 Dreamliner represents a major production innovation and an initial marketing success, there are formidable challenges associated with its production. As stated above, composites are being used to an unprecedented extent. At the same time, 70% of the aerostructure workload (i.e., fuselage, wings, and flight control surfaces) is being outsourced—entailing a degree of cooperation and coordination that has never been attempted before. For example, fuselage barrels and wings are produced by Alenia in Italy, Spirit Aerosystems in Wichita, KA and Vought in Charleston, SC.

To rapidly move the completed assemblies to Boeing's plant near Seattle, Boeing has enlarged four 747-400 aircraft to create "Dreamlifters," which can haul more cargo by volume than any other aircraft in the world (Beauclair, 2007; Boeing, 2008).

The difficulties of coordination and the rapid development of this revolutionary aircraft have led to multiple redesigns of critical components, notably the center wing box, which is the structural "core" of any aircraft. Additionally, the intense levels of communication and cooperation required by outsourcing have not always materialized, with expectations of suppliers at all tiers needing downward adjustment in many cases.

The 787 program involves about 30 key "Tier 1" suppliers. Each of these is being asked to receive parts from Tier 2 and 3 suppliers, fabricate assemblies and test them so that they are ready for incorporation into the aircraft. Essentially, Boeing realized it needed to spread the risk as well as the development costs of the 787. A notable 70% of the aircraft, measured by the cost of parts and labor, comes from overseas (Crown & Epstein, 2008).

This approach was intended to shorten cycle time and significantly reduce the research, development, and production costs needed to build such a novel design. When this complex system began to break down, Boeing had all suppliers deliver to its Seattle-area plant, causing chaos. The result is a current production delay of about 19 months over that originally forecast, with launch now estimated in early 2010.

The supply chain problems, which were the largest cause of production delays, other than the design of the center wing box, would seem to have been preventable. While Boeing has a long history of working with certain suppliers, the fast pace of 787 development and production required bringing completely new partners into the network, for critical assemblies, often from overseas. Wayne Plucker of the consulting firm Frost & Sullivan described the situation as follows:

It hasn't been as big a brouhaha as occurred at Airbus, which took the "everything is fine" routine, a lot of which was for internal consumption. In Boeing's case, it was more that they didn't really go out and aggressively check on their suppliers, he says. Boeing has had many years of trusted relationships with suppliers, from whom they got consistent results. With this airplane, they went out and got a whole bunch of new suppliers from every conceivable country on Earth and then didn't pay attention, didn't check them out, and they got sunshine reports too much. That was what led to the program management change—the new guy has a history of being a company trouble-shooter, making things work. And he was the one who made the decision to formally delay to make sure they would have time to fix things. (Wilson, 2008)

When supply chain problems began, Boeing management did not try to increase communication or provide assistance to the suppliers; rather, they tried to resolve the problem by taking assembly responsibility away from the Tier 1 suppliers as described above. Richard Aboulafia of the Teal Group, a well-known aviation consultant, explains the cultural environment of Boeing's purchasing practices:

Aboulafia goes so far as to predict that big international commercial manufacturers such as Boeing eventually will develop a system of on-site contract supervision not unlike the US government's defense contract auditors. "Without the same top-heavy bureaucracy, it is heading in that direction, for sure," he says. "You can't just outsource without direct supervision, without verification. Everyone has been moving more and more design and integration responsibility to the subcontractors, but without adequate oversight, they might have leaped too far. They just assumed a contract and a handshake meant everything would show up on time, because it had in the past, and that was just the way business was done. (Wilson, 2008)

The situation seems remarkable, even allowing for the complexity and challenges of the 787 and the use of a global aerospace industry. The comparison with the defense industry is also interesting, as we will discuss below. The issue of the nature, quality, and sustainability of Boeing's in-house expertise and production capabilities with respect to commercial aircraft has become a commonly-discussed issue in the aerospace media (Epstein & Crown, 2008).

These difficulties are related to Boeing's longstanding white-collar labor relations difficulties and wide swings in employment levels. All these factors

influence the extent to which Boeing can either competitively produce an aircraft or parts thereof by itself or has been forced by its management practices and labor relations into a position where meeting the tough deadlines imposed by competitive forces leaves Boeing with the sole choice of global outsourcing.

David P. Hess, the president of Hamilton Sundstrand—Boeing's leading systems supplier for the 787 and a subsidiary of United Technologies—provided some interesting insights in an interview with *Aviation Week & Space Technology* that led to a large number of letters to the editor. Hess' comments deal not only with the 787 supply chain issue (which he feels has been successfully resolved) but with the relationship of outsourcing to Boeing's long-term corporate strategy. The benefits and costs of Boeing's approach need to be carefully weighed, as it can also benefit suppliers:

Boeing initially won kudos from investors for outsourcing the design and production of key 787 structures to partners across the US, Europe and Japan. The company also required those suppliers to make hefty investments, allowing Boeing to spread the project's risk. But the logistics breakdown has raised questions about whether the strategy will succeed. Some workers have criticized the outsourcing and say the company hasn't retained enough engineering talent to ensure that work is being done adequately.

But Hess says the streamlined production model was key to allowing Hamilton Sundstrand to quickly implement innovations to the electrical system needed for the aircraft to achieve its higher fuel efficiency. In the old days, he notes, Boeing would have had to waste time and money vetting and coordinating such changes among an array of suppliers.

Hess acknowledges that the 787's logistics model is challenging. He estimates that only 10% of Hamilton Sundstrand's components go directly to Boeing, with the rest being shipped to top-tier structures suppliers such as Spirit AeroSystems, Global Aeronautica and Mitsubishi Heavy Industries. Those companies then integrate the systems into their structures before shipping them to Everett for final assembly. "If you look at managing that supply chain and keeping it all synchronized and schedules harmonized, it's complex," Hess says.

Still, he predicts Boeing's maligned supply chain model will ultimately prove sound. It will take them a little while to get it ramped up and synchronized.

But once they get to that point, I think it will be a big benefit to them.
(Anselmo, 2008)

Since the 1980s, management practices that originated with Toyota involve end-item manufacturers carefully monitoring supplier performance, place representatives at supplier plants (and vice versa), and be ready to “jump in” and assist suppliers to improve their processes within the context of a long-term, cooperative relationship (Avery, 2007; Liker, 2003; O’Sullivan, 2006).

As described in the quotation above, this eventually happened with the Dreamliner, but Boeing would have done better to recognize this problem when planning to radically increase the number and responsibilities of its suppliers.

The production delays have benefited some airlines, particularly in the US, which are rapidly losing money due to fuel costs, and they view the delay as a lucky occurrence (Moad, 2007; Matlack, 2008). Ironically, less than 6% of Dreamliner orders are from US carriers, whose current losses are compounded by the higher fuel consumption and maintenance costs of older aircraft. For example, when American Airlines was ordered in early 2008 to ground its MD-80 aircraft for wiring inspection, the average age of the aircraft was 18 years. The lack of internal or external capital available to US airlines to finance new aircraft compounds the issue and leads to a vicious circle.

Proposals by the current Administration to expand permissible foreign ownership of US airlines from 25% of voting stock and 49% of total stock have been blocked in Congress, keeping cash-rich European carriers from investing in US airlines. Allowing increased foreign ownership and control by European Union (EU) member states is a prerequisite for complete implementation of the EU-US bilateral aviation agreement, whose initial phases recently went into effect. US airlines have been quick to take advantage of increased access to Europe, shifting flights from money-losing domestic US routes to more lucrative transatlantic flights and reducing domestic capacity further by similarly moving widebody aircraft to transatlantic routes (Kushner, 2008; Zumbun, 2008).

However, given that almost all of Boeing's 787 customers are more profitable foreign carriers, the firm's current situation has been described as follows:

If airliner orders continue at their present pace—the company has won more than 400 orders through the end of May—the company will add more than 900 planes to its backlog this year. Boeing already has enough airliners on back order to keep its Washington production lines moving at the present pace for up to seven years without another order in the interim. The fuel crisis is causing some airlines to postpone orders, but the company's conservation production pace can be sustained for years even if orders begin melting away. (Gillie, 2008)

At least in the near term, it appears that the Dreamliner will appear mostly in foreign airlines, whose healthier financial condition allows for modernized fleets with more comfortable and fuel-efficient aircraft with lower maintenance costs.

Implications for Design and Production of Military Aircraft

There are only two manufacturers of what we would characterize as large airliners.⁴ These would be aircraft destined to carry passengers or commercial cargo that exceed the size of regional jets and turboprops. There a number of implicit characteristics of how Boeing and Airbus deal with their (principally) airline customers, as well as with leasing firms (since the majority of airliners today are leased by the airlines, the leasing firm retains ownership).

Airlines or leasing firms, particularly those with a history of doing business with Boeing or Airbus, are consulted early and frequently during the design of a new aircraft (or variant). The airlines' specific needs can be generally described. They are primarily interested in capacity (i.e., passenger and/or cargo of different types), passenger comfort and amenities, range, noise, weight, cruising speed and altitude, fuel consumption, carbon emissions, and the performance of the aircraft in

⁴ For example, Aviation Week's 2008 Aerospace Source Book (pp. 74-77) lists only Airbus and Boeing as international suppliers of wide-body turbofan air transports.

combination with one or more engine types (which have traditionally been offered by the engine manufacturer and chosen by the customer).⁵

Changes in technology, like the use of composites, integrated avionics (e.g., the “glass cockpit” with a small number of electronic displays replacing hundreds of dials, gauges and switches) and electronic flight bags (replacing the bulky charts and rule books carried by the pilot and first officer), emerge gradually and are incorporated in a relatively smooth manner into new aircraft types and are often retrofitted into older models (just as newer, quieter and more fuel efficient engines are placed on older airplanes).

While the above description is necessarily simplified for purposes of this discussion, the end-item assembler or “airframer,” (i.e., Boeing or Airbus) requires expertise sufficient to develop and produce the entire aircraft (or alternatively to maintain requisite in-house knowledge to effectively work with suppliers at all tiers). For example, while Boeing has never produced an aircraft engine, engine design is a critical part of aircraft design. The same could be said for the hundreds of electronic systems (or “avionics”) installed onboard that present a major challenge for systems integration.

Airlines and aircraft leasing firms are the key buyers of aircraft, and they must also have considerable in-house expertise to advise Boeing and Airbus of their requirements and to subsequently operate and maintain the aircraft. However, the principal base of both tacit and explicit knowledge in all aspects of aircraft design, development, manufacturing, assembly, operation and maintenance resides with Boeing or Airbus.

Outsourcing gives these two airframers more flexibility to obtain the best products globally and hopefully allows suppliers to advance their own knowledge base within their own product lines (e.g., engines, avionics, or production of

⁵ However, some airliners like the Boeing 757, have been offered with only one engine type.

composite fuselage sections). But Boeing or Airbus must remain the “knowledgeable customer” down to at least a certain level of subsystem. These two firms are the world leaders not because they have expertise in final assembly of a decreasing number of physical parts, but because they have a duopoly on the design and integration of the entire airliner as a system.

The above discussion of commercial aircraft practices is meant to give some context when considering practices and trends related to military aircraft. It is true that some aircraft have almost identical airframes and engines than their commercial counterparts (such as the Boeing P-8A Poseidon, a derivative of the 737-800). Others, such as fighters, have little in common as far as requirements, physical characteristics or performance expectations.

But the difference between generally commercial or military aircraft extends further. For a nation’s defense organization to oversee the entire process of the aircraft lifecycle from initial research through to production, operation and maintenance requires far more in-house knowledge of the various aircraft-related disciplines than any commercial airline would need. The sheer scale of the necessary knowledge base and physical infrastructure limits the role of military aircraft development to only a few countries in the world, principally the US, the United Kingdom, France, Sweden, Russia and China.

Other nations’ flying services import their aircraft from one of these countries and benefit from stable designs proven in service. In some ways, importers of military aircraft are like airlines and can maintain a reduced in-house knowledge base.

The critical difference between the two markets and types of aircraft, therefore, relies on what has been systems maturity or technology readiness level (GAO, 2006; GAO 2008c). In particular, the DoD often requires the development, production and integration of technologies that do not yet exist or are immature. This practice may be viewed as either the cause or the effect of long team times to develop and field a new military aircraft—often exceeding 20 years. A contrasting

example of commercial aircraft strategy is given by Boeing's approach to develop a replacement for its 737:

Boeing is abandoning its long-running effort to devise a successor to the 737, driven back to the drawing board by the lack of existing technology that can deliver the huge leap in performance airlines want for a next-generation single-aisle aircraft.

The decision to disband the 737RS (replacement study) design project, because it fell short of critical performance targets, has implications beyond Boeing. It will likely influence how Airbus moves forward on its A320 replacement effort, the A30X. For airlines, it means an even longer wait until a 737 or A320 follow-on hits the market.

For Boeing, the focus now switches to more fundamental research into aerodynamics, composites and other advanced alloys and hybrid materials, systems and propulsion in the hope that concepts will emerge to meet the challenge.

The manufacturer openly admits the change of strategy, saying, "We know customers are demanding really high targets for this aircraft, and we know that with the state of technology, we're not going to get there anytime soon." As a result, Boeing adds, "We're focusing on technology efforts and reducing the aircraft design effort while the technology matures." (Norris & Wall, 2008)

Essentially, Boeing's board will only authorize the firm to offer for sale an aircraft that offers a controlled amount of risk in return for the revenues, profits and resulting market share. While it is often said that Boeing or Airbus "bets the company" on each new model, the wager is a carefully considered one. The DoD deals with an entirely different set of concerns and acts accordingly, and the results have been summarized as follows.

Leading commercial companies use three key techniques for successfully developing and transitioning technologies, with the basic premise being that technologies must be mature before transitioning to the product line side.

- **Strategic planning at the corporate level:** Strategic planning precedes technology development so managers can gauge market needs, identify the most desirable technologies, and prioritize resources.
- **Gated management reviews:** A rigorous process is used to ensure a technology's relevancy and feasibility and enlist product line

commitment to use the technologies once the labs are finished maturing them.

- **Corroborating tools:** To secure commitment, technology transition agreements solidify and document specific cost, schedule, and performance metrics labs need to meet for transition to occur.

Relationship managers address transition issues within the labs and product line teams and across both communities. Meaningful metrics gauge project progress and process effectiveness.

Not only does DoD lack the breadth and depth of these techniques, the department routinely accepts high levels of technology risk at the start of major weapon acquisition programs. The acquisition community works with technologies before they are ready to be transitioned and takes on responsibility for technology development and product development concurrently [...] A defined phase for technology transition is not evident. These shortcomings contribute significantly to DoD's poor cost and schedule outcomes for developing technology.

The numerous examples of DoD programs that have incurred cost overruns, schedule delays, and reduced performance serve as reminders that inserting a few best practices and changing the mechanics of technology transition processes without changing the environment that determines incentives may not produce better outcomes. (GAO, 2006)

Another major factor beyond the scope of this paper but worth mentioning is the particular nature of globalization's impact on the defense and aerospace sector, with Cold-War era US legislation such as the Berry Amendment (requiring certain metals come from US sources) and the International Traffic in Arms Regulations (which create a complex system of technology export controls).

To some extent, "workarounds" allowing specific exports to partner nations and their industries have been developed by the Administration through multiple bilateral agreements providing a security "perimeter" around the US and each of the other nations with respect to individual programs. This is how the multinational Joint Strike Fighter is being managed. However, a sound national or multinational system has yet to emerge, and the post-Cold War multilateral regime, centered on the Wassenaar Arrangement and a number of other agreements, is not trusted by the Administration or Congress (Demisch, 2006). Congress does not hesitate to act

unilaterally, for example, through an outright ban on exports of the Lockheed Martin F-22 Raptor aircraft, which was highly desired by Japan (Shiibashi & Perrett, 2007).

In our view, a major reform of technology export controls is a prerequisite to any significant degree of globalization of the defense industry. However, even the defense industries and armed services of the three closest allies of the US—Australia, Canada, and the United Kingdom—have suffered during the post 9/11 period from what is well understood as a high degree of risk aversion by the US Administration and Congress. Realistically, there will be little to no support for serious reform until the globalization of the commercial aircraft industry backs the US government and defense industry into a corner, with attendant potential for the domestic loss of jobs, exports, or votes.

While the decision to offer and launch production of the 787 represented a risk for Boeing, the firm followed all of the steps recommended above to effectively manage that risk. To do otherwise would make no sense in a competitive environment. Not only do Airbus and Boeing depend on a steady flow of production and orders for aircraft, but airlines do as well. An excellent example is the record sales level achieved by the 787 with the impact of its reduced fuel consumption and (perhaps) higher degree of passenger comfort, which will have an effect on airline revenues and profitability.

Conclusion

The unprecedented degree of outsourcing and globally dispersed suppliers for the Boeing 787 Dreamliner has been controversial, and the delivery delays of the completed aircraft caused by poor supply chain management (essentially a lack of attention to basic supplier relations) have significantly impacted Boeing's short-term profitability. However, Boeing currently retains the capability to profitably design and produce a start-of-the-art aircraft.

A key lesson learned for the DoD is that the endless repetition of the term “commercial practices” as a goal for the Department and its contractors is not a

simplistic exhortation to emulate the practices of businesses engaged in the production of large systems. Rather, the maintenance of the fundamental knowledge base in-house within the DoD and its prime contractors is essential if the US is to remain a viable weapons producing nation.⁶

Furthermore, the erosion of expertise in areas such as research, engineering, contracting and logistics within the DoD constitutes a similar threat in that the necessary knowledge can be gained only over time during a coherent career in the military or the civil service. Without it, the DoD (or any other military establishment) cannot remain a knowledgeable customer. And, only a knowledgeable customer can ensure that its suppliers continue to perform adequately. To avoid these threats, the DoD needs relief from legal, regulatory and congressional restrictions that are inconsistent with the realities of globalization. Also, the DoD must manage its human capital to develop the expertise to effectively manage a wide variety of sourcing arrangements—either by its prime contractors or lower tiers in the supply chain.

⁶ We reach similar conclusions regarding the UK in our discussion of the UK's Defense Industrial Strategy. (Franck, Lewis, & Udis, 2008, pp. 94-106).

Section III. The KC-45 Competition

Introduction and Overview

This section extends and updates our discussion of the KC-45 (nee KC-X)⁷ competition for the next generation Air Force aerial tanker. Our previous report on this same subject focused on EADS-Airbus' actions to enter the North American (especially US) defense market (Franck, Lewis, & Udis, 2008, pp. 108-116). We considered this matter from the perspectives of offsets in international defense trade, vertical firm boundaries (primarily with Transaction Cost Economics), and corporate strategy (drawing upon some standard models). While we found considerable explanatory power from all three perspectives, the corporate strategy view proved especially useful.

This report continues with that EADS-centered viewpoint in another section, as we consider its strategy for direct investment in the US defense market. However, this particular section is primarily focused on the US Department of Defense: the Air Force in particular. Our discussion will proceed as follows.

First is the context in which the KC-45 competition has been conducted. Aerial refueling is clearly a core competence of the US Air Force and the US military establishment in general. Power projection depends upon deep strike operations—much of which is accomplished through manned aircraft. Aerial refueling of strike aircraft is a *sine qua non* of deep strike missions. Accordingly, it was reasonable to place high priority on acquiring a new tanker to replace part of the aging KC-135 fleet. However, the KC-X was viewed as only part of the (very) long-term solution. We will also discuss the outlines of the overall aerial refueling plan,

⁷ We will use KC-X and KC-45 as being largely interchangeable. The project started as the “KC-X” and was designated KC-45 in early 2008. The NG-EADS proposal for the KC-X was generally called the “KC-30;” the Boeing proposal, the “KC-767.”

Second, we'll summarize the events which led up to the KC-X competition between Boeing (KC-767) and Northrop Grumman-Airbus EADS (KC-30). The major developments included (a) the abortive attempt to acquire 100 KC-767 tankers (some leased) from Boeing, and (b) EADS' efforts to enter the US defense market.

Third are the major events associated with the original KC-45 competition. Of special interest are (a) the NG-Airbus threat to not respond to the original Request for Proposal (RFP) in early 2007, and the Air Force response, (b) the selection criteria (although not publicly available as yet), and (c) the events surrounding the original award to the KC-30 proposal.

Fourth is the Boeing protest and subsequent events. We'll consider Boeing's major complaints, the inside-Beltway response and the GAO decision. The aborted recompetition for the KC-45 contract will conclude our discussion of this particular case.

Finally, we'll offer some tentative observations and conclusions from this particular case. They are tentative because the KC-45 competition is an ongoing story. Much of the relevant information has not yet been released and documents which have been released (e.g., the GAO decision on the Boeing protest⁸) have much that's both interesting and useful redacted from the public version. As a result, we've relied on press reports and press releases more than one would prefer in a scholarly report. While these have been both informative and useful, they should be regarded as only tentatively authoritative—pending the release of the full record.

Background

Aerial refueling is clearly a core competency of the US military establishment (especially the Air Force). A longstanding American strategic tradition prescribes engagement of threats in areas other than the homeland as a highly preferred mode

⁸ For example, the public version of GAO (Boeing Decision, 2008a) contains a large number of redactions.

of operation; in fact, there's good reason to believe that the proposition that wars should be fought as far away as possible from the homeland is a major (if not explicit) foundation of US national security and military strategies.

Accordingly, the ability to “project” military power to distant areas (“theaters”) is a necessary foundation for executing US military strategy. Power projection against reasonably strong opposition is difficult, at best, without significant capability for long-range strikes. The primary vehicles for such strikes are manned aircraft—at ranges significantly beyond their nominal range-payload capabilities. The long-standing solution for this particular problem is aerial refueling—mating tankers with strike aircraft to extend their combat range.

Therefore, the US Air Force has maintained large and capable aerial refueling fleets ever since it learned how to do aerial refueling reliably. Post-World War II aircraft have included bomber variants such as KB-29s and KB-50s. But the most successful tankers were variants of commercial transports: KC-97 (Boeing 377), KC-135 (Boeing 717), and KC-10 (McDonnell-Douglas DC-10). Most current US aerial refueling capability resides in some 59 KC-10s and 500+ KC-135s. In the 1990s (following the Cold War), this force was generally considered adequate to meet refueling needs for some time to come.

However, with the end of the 1990s, some second thoughts had emerged—associated primarily with the age of the KC-135 fleet—delivered between 1957 and 1965.⁹ Risks associated with these aging airframes were, (1) increasing maintenance costs (perhaps rapidly increasing), and (2) low availability due, among other things, to structural aging and unforeseen failures. Difficulties with KC-135Es

⁹ These concerns were well documented in formal reports such as Defense Science Board (2004), and Kennedy et al. (RAND, 2006), and Keating and Dixon (2003).

have both confirmed these concerns and brought greater attention to the KC-135 age issue.¹⁰

Given the importance of aerial refueling and the risks associated with the KC-135 fleet, it seemed prudent to (a) start recapitalizing the fleet, and (b) hedge against serious availability problems with KC-135s.¹¹ The first initiative along these lines began in 2001—in an effort to lease 100 tanker versions of the Boeing 767. Following an extended period of challenges, compromises and scandals, this “KC-767” program was abandoned.¹²

The new tanker initiatives were conceptually founded on a strategy for replacing the entire fleet. Over a period of decades, the Air Force proposed to field 600 KC-135R-equivalents with (notionally) three new tankers: KC-X, -Y, and -Z – each (notionally) offering about 200 R-equivalents of refueling capability.¹³

The original Boeing 767 lease-and-buy proposal was replaced by a competition for a new Air Force tanker. The program was conceived as totaling 179 aircraft. Boeing responded with a proposal featuring KC-767s. Tanker variants of the Boeing 767 are scheduled for service with the Italian Air Force and the Japanese Air Self Defense Force. Northrop-Grumman¹⁴ and EADS responded with the “KC-

¹⁰ Both KC-135Es and KC-135Rs are modified KC-135As (the original model delivered with J57 turbojet engines). In the 1980s, the E models were re-engined with used commercial engines (JT3Ds, low-bypass turbofans) —many of which were available due to Boeing 707 retirements from commercial service. The R models received new high-bypass turbofans (CFM-56s). While improved fuel efficiency made both models better tankers, the R models received a much more extensive upgrade (rudder, landing gear, engine struts, etc.), which extended their operational life. The E models, which were much less extensively upgraded, not surprisingly, have shown more signs of aging.

¹¹ With constant refueling capability, those 100 KC-767s would have permitted retiring all KC-135Es and about 65 KC-135Rs – leaving the bulk of the KC-135 force still in service.

¹² These rather bizarre episodes were summarized nicely by Knight, et al. (2008), pp. 31-32.

¹³ For an excellent summary of this tanker “road map.” Consult Knight (2008, pp. 16-17).

¹⁴ The partnership EADS with Northrop-Grumman in offering the KC-30 seems to have been at least partly the result of EADS’ strategic calculations, within the larger context of establishing itself as a major supplier to the US defense establishment. This is discussed in some of our previous work. (Franck, Lewis, & Udis, 2008, pp. 108-116.)

30,” a variant of the Airbus A330. The KC-30 is programmed for service with Australia, Saudi Arabia, United Arab Emirates and the United Kingdom.¹⁵

Table 1. Key Performance Parameters for the KC-X Competition

KPP	Brief Description	Required Performance
1	Aerial Tanker Capability	Able to refuel all current & programmed fixed-wing aircraft
2	Fuel Offload	Fuel-Range characteristics equivalent to KC-135R
3	Communications, etc.	Able to operate worldwide in military and civil airspace
4	Airlift Capability	Able to carry passengers, patients, palletized cargo
5	Receiver Capability	Able to refuel inflight from boom-equipped aircraft
6	Force Protection	Able to operate in chem. And bio. Environments
7	Net-Ready	Conform enterprise-level critical architecture standards
8	Survivability	Various detection means and countermeasures
9	Multi-point Refueling	Multi-point drogue refueling

(Source: GAO, 2008a, pp 5-6)

The essentials of the competition involved, first, a set of Key Performance Parameters (KPPs) and a “best value” evaluation. The KPPs are summarized in Table 1 above.

Basically, satisfying the KPPs was the test for admission to the final selection. The “best value” assessment considered the following factors. These are summarized in Table 2 below.

The final KC-X Request for Proposal (RFP) was made available on January 31, 2007. The KC-30 team (EADS-Airbus and Northrop-Grumman) objected to an earlier version—citing, among other things, the ramp space requirements

¹⁵ Wikipedia, Airbus A330, Boeing 767. This was the case at start of the KC-X competition. Other sales are, of course, possible.

specified—which seemed to favor the smaller (Boeing) KC-767.¹⁶ Although the details were not reported fully in the open press,¹⁷ the Air Force apparently revised that aspect of the RFP in response to the KC-30 team’s objections (Cole & Lunsford, 2008).

Table 2. KC-X Best Value Selection Criteria

Mission Capability
Key System Requirements; System Integration and Software; Product Support;
Program Management; Technology Maturity and Demonstration
Proposal Risk
Past Performance
Cost/Price
Integrated Fleet Aerial Refueling Assessment (IFARA)

(Source: GAO (2008a, Boeing Decision, pp. 6-13.)

KC-30 and KC-767 Compared

Basic specifications for US tanker and transport aircraft are summarized in Table 3 below. The characteristics featured in the table address operationally relevant characteristics that have been featured in the KC-X competition. The basic size of the airframe (wing span and fuselage length) is a primary determinant of parking ramp “footprint.” Among other things, this determines how many aircraft can be parked at a given airfield.

¹⁶ As Table 3.3 makes plain, the KC-30’s ramp “footprint” is greater than existing tankers, and the KC-767’s.

¹⁷ For reasons that are well founded, US Government disclosures regarding the KC-X competition, so far, are usefully characterized as following a standard of minimum essential transparency.

Maximum fuel is a major determinant of overall air refueling capability.¹⁸ The KC-30 has been estimated as being equivalent (on average) to 1.2 KC-767s, which correlates nicely with the ratio of the maximum fuel loads (~1.2).¹⁹

Maximum Pallets is a measure of ability to carry “bulk” cargo—stated in terms of standard military 463L cargo pallets. Pallets are used to package smaller pieces of cargo, among other things, to expedite and better organize unloading in theaters of operation. Note that both KC-X candidates have excellent bulk cargo capabilities. They can carry more pallets than the C-17—Air Mobility Command’s newest airlifter. Further, KC-30s can transport more pallets than KC-10s and a number comparable to C-5s. Also, the KC-767 can carry more pallets (19 vs. 13) than the C-141—a highly effective airlifter for almost four decades.²⁰

¹⁸ Aircraft fuel efficiency is also important. The KC-135R is considered 50% more capable than the KC135A, due primarily to high-bypass turbofans replacing turbojets. All aircraft in this table feature high-bypass turbofan engines. However, the KC-767 has been assessed as having 35% more capability than a KC-135R—due primarily to greater fuel efficiency (from both airframe and engines).

¹⁹ The underlying calculations for that ratio apparently come from the Contingency Mating and Ranging Program (CMARPS), an Air Mobility Command analytical tool. GAO Decision, 18 June 2008, p. 12. (It is interesting to note that some internet sources list CMARPS as *Combined* Mating and Ranging Program.) The ratio in question (1.2:1) has, to our knowledge, never been officially released. However, it was touted in a Northrop Grumman press release, repeated elsewhere, and never (as far as we can determine) been challenged (even by Boeing). NG Press Release, Northrop Grumman Tanker is 20 Percent More Capable ...”, 18 February 2008.

²⁰ 463L article (undated) from Global Security.org. However, bulk cargo isn’t the only airlift category. There are “oversized” items (such as trucks and ground equipment) and “outsized” items such as tanks. Moreover, mission configuration for any of these aircraft involves a tradeoff involving payload (cargo transported to a destination and fuel offloaded to receiver aircraft) and range to be flown. This latter tradeoff is commonly summarized in the aircraft’s range-payload curve.

Table 3. Key Characteristics of Selected Tanker and Transport Aircraft

Character- istics	Current Tankers		Current Transports		Proposed Tankers	
	KC-135R	KC-10	C-5	C-17	KC-767	KC-30
Wing span / Length*	131/136	165/181	223/247	170/174	156/159	198/192
Max. fuel***	200	356	330	--****	200+	245
Maximum Pallets***	6	27	36	18	19	32

* Feet. ** Thousands of pounds. *** Military (463L) pallets. Smaller than standard commercial pallets. **** Not readily available. Varies with model; majority are “ER” designated.

(Sources: Knight et al. 2008, pp.34-37.) 463L information from GlobalSecurity.org; Wikipedia articles and Air Force fact sheets for C-5 and C-17

The Competition

Conscious of the possibility of an award protest, and the clear possibility of that protest being sustained, the Air Force described the competition as being especially open and carefully conducted. (Among other significant events, two previous awards to Boeing—the new CSAR-X helicopter and a significant KC-135 support contract—had already been successfully contested.)

Because of the high stakes involved, both parties engaged in an energetic campaign to mobilize public support and congressional delegations. Boeing emphasized the number of US jobs attributable to a KC-767 selection, while the KC-30 countered with an ever-more lucrative industrial participation scheme. This started with a proposal configuring basic (“green”) A330 airframes for aerial refueling in Alabama. In early 2008, the offer was sweetened with announced plans to open an A330 freighter assembly facility in Alabama as well (Franck, Lewis, & Udis, 2008, pp. 108-111). In previous work, we presented this as an implicit negotiation over an offset package (p. 111).

On February 29, 2008, the Air Force awarded the KC-45 contract to the NG-EADS KC-45 entry (Michaels & Cole, 2008). The outcome appeared to catch all

concerned by surprise (except the Air Force source selection insiders). The Air Force ratings (insofar as they are readily available) were as summarized in Table 4 below.

The table indicates that both firms offered proposals that met Air Force needs. Life Cycle Cost differences were well within any reasonable view of cost estimates' margins of uncertainty. It's reasonable also to conclude that the competition (according to Air Force rules) was close.²¹ Nonetheless, there was surprisingly (in our opinion) negative coverage of the Boeing entry, and the Boeing Corporation, in the US press. Headlines like "Boeing vs. Bold Ideas" and references to the KC-767 as "frankentanker" were readily evident in published articles (Bailey, 2008; Herszenhorn, 2008).

Table 4 Evaluation of KC-767 and KC-30 Proposals

Mission Capability/Proposal Risk		KC-767 (Boeing)	KC-30 (NG-EADS)
	Key System Requirements	Blue ^{***} /Low	Blue/Low
	Systems Integration/Software	Green/moderate	Green/moderate
	Product Support	Blue/Low	Blue/Low
	Program Management	Green/Low	Green/Low
	Technology Maturity	Green	Green
Past Performance		Satisfactory Confidence	Satisfactory Confidence
Cost/Price (MPLCC)*		\$108.044 Billion	\$108.010 Billion
	Cost Risk: Development/ Production & Deployment Phases	Moderate/Low	Low/Low
IFARA** Effectiveness Value		1.79	1.90

* Most likely Lifecycle Cost ** Integrated Fleet Aerial Refueling Effectiveness

^{***} Color rating scheme (Blue, Green, Yellow, Red) Blue is best; Red worst.

(Source: GAO, 2008a, pp. 17-25)

²¹ This assessment was also reached by the GAO in its Boeing Decision. (GAO, 2008a, p. 16).

After meetings with the Air Force, Boeing mounted a rather strong protest to the KC-45 contract award on March 11, 2008.²² Boeing's major complaint was that the KC-767 was closer to being the tanker the Air Force originally had in mind, citing a "significant gap between the aircraft the Air Force set out to procure [...] and the much larger Airbus A330-based tanker it ultimately selected." The Boeing press release continued: "It is clear that frequent and often unstated changes [...] — including manipulation of evaluation criteria and application of unstated and unsupported priorities [...] resulted in selection of an aircraft that was radically different from that sought by the Air Force..." (Boeing, 2008 March). According to public statements, the Boeing protest was more specifically motivated by the following serious flaws in the Air Force evaluation process.

- "credit" given for passenger and cargo capabilities;
- evaluation of risks associated with the two proposals;
- cost assessments;
- effects of basing characteristics (primarily ramp space needs). (Cole, 2008, p. B2)

While the Government Accountability Office (GAO) was considering the protest, the public relations and political campaigns continued. The NG-EADS congressional supporters (especially Alabama) supported the Air Force decision. The Boeing congressional supporters (especially Washington state) expressed outrage at the award of manufacture of a critical military system to a foreign entry. As noted above, there is strong evidence for characterizing the KC-45 as "critical." To characterize the NG-EADS proposal as "foreign" became increasingly debatable. With NG participation and the Alabama facilities in place, both proposals were estimated to have a large American content. In fact, some argued that the US content of the KC-30 would likely exceed that of the Boeing 787.

²² The extent to which the press's and think-tanks' public ridicule of Boeing were a consideration in the company's decision to protest the award are nothing more than a matter for speculation at this point. A good example is a Lexington Institute release, Thompson (2008). "Mobbing" is discussed in Gravois (2006).

In what appears to be a direct response to the Boeing protest, Northrop Grumman issued a number of “why we won” press releases—dated from 23 April until 12 June, shortly before the GAO announcement concerning the protest. The essential points cited were

- Air refueling capacity and “efficiency”
- Airlift capacity
- Airframe performance, especially takeoff and range
- Cost, especially development cost
- Survivability
- Overall fleet effectiveness.²³

The Protest Sustained

Taking full advantage of the 100-day assessment period, the GAO ruled in favor of the Boeing protest—on June 18, 2008. While finding merit in “only” eight of Boeing’s 100 (or so) issues, the GAO decision was nonetheless strongly in favor of the Boeing position—and also a surprise to those considered insiders in the Washington, DC area.

The essentials of the GAO findings were given in a 3-page summary statement, also issued on June 18, which accompanied a more detailed 68-page decision. The bottom-line conclusion was that the Air Force selection process contained substantial flaws, which may well have reversed the choice of winner (GAO, 2008b, p. 2; GAO, 2008a).²⁴ More specifically, the main findings in Boeing’s favor were as follows:

- Insufficient credit to Boeing for meeting non-mandatory technical requirements;

²³ The entire series is available at http://www.northropgrumman.com/kc45/media_center/archive.html.

²⁴ GAO, 2008b, p. 2. GAO, 2008a).

- Additional refueling capability as a “key discriminator” assigned to the KC-30, despite evaluation rules that no credit would be assigned for doing that;
- Insufficient support for determination that the KC-30 could refuel all Air Force fixed-wing receiver aircraft;
- “Misleading and unequal discussions” with Boeing concerning satisfaction of a key performance parameter;
- Improper determination that Northrop-Grumman’s “refusal” to support organic depot maintenance according to solicitation requirements was an administrative oversight;
- Unreasonable determination of life cycle cost estimates;
- Improper increase of Boeing’s estimated engineering costs (as part of the life cycle cost estimate). (GAO, 2008b, pp. 2-3)²⁵

Taken at face value, the GAO findings are a strong affirmation of the overall tenor of the Boeing protest, if not all its details. It’s especially noteworthy that the GAO’s main findings may go beyond the allegations in the Boeing complaint (at least as they’ve been reported in the press).

The GAO recommended that the Air Force basically restart the competition, to include “reopen(ing) discussions with the offerors.” It also recommended that the statement of Air Force needs be reformulated if the original version did not meet aerial tanker needs (GAO, 2008a, p. 67).

One of the more interesting developments associated with the GAO decision was EADS’ immediate decision to defer (indefinitely) the KC-45 (and A330) production facilities in Mobile, Alabama.²⁶ Despite EADS statements (Tran, 2007) regarding the advisability of locating production facilities in areas with the US dollar as currency, this supports our previous conclusion that EADS-Airbus plans for facilities in Alabama were part of an offset negotiation (albeit implicit) (Franck, Lewis,

²⁵ Ibid., pp. 2-3.

²⁶ Northrop Grumman Media Advisory dated 19 June 2008. This matter is also discussed in Section 4 of this report.

& Udis, 2008, p. 111). Another interesting development is that the Air Force became the new target for public mobbing—with press and congressional sources openly questioning the competence of the service.²⁷ Probably the most direct assessment is attributed to Rep. Norm Dicks (WA), “No one has any faith in the Air Force” (Associated Press, 2008 July 9)..

The New Competition

DoD accepted the GAO's major recommendations. It amended the criteria for evaluation—most significantly in awarding credit for exceeding refueling capability requirements (which clearly favored NG-EADS)²⁸ and extending lifecycle cost estimates to 40 years (which probably favored Boeing). The Office of the Secretary of Defense (OSD) replaced the Air Force as the source selection agency—clearly not a vote of confidence. Also, a limited new competition was put on a fast track²⁹—with the goal of concluding the source selection by the end of 2008 (which likely favored NG-EADS). On August 6, 2008, both companies received this information in the form of a 98-page document that stated “amendments and clarifications” to the original request for proposals (RFP).³⁰ Meetings with both Boeing and NG-EADS were reported in mid-August (Butler, 2008 August 15). Stated dates for the final RFP slipped from mid-August to early September (Shalel-Esa, 2008; Weber, 2008).

Sensing what it perceived as an uneven playing field, Boeing essentially repeated the NG-EADS ploy of early 2007. It publicly stated that the timelines for the new draft RFP did not permit time for Boeing to submit a competitive proposal—(Franck, Lewis and Udis (2008), especially pp. 108-111) which could take the form of a tanker version of the Boeing 777, a substantially larger aircraft. According to a

²⁷ Gravois describes “mobbing” in academic settings. (Gravois, 2006)

²⁸ The revised RFP was quoted in the press as follows: “There is additional value to the government for the additional fuel offload amount above the threshold” (Shalel-Esa, 2008).

²⁹ According to press reports, the “limited rebids” would consider only the issues in which the GAO found fault with the original source selection. *Ibid.*

³⁰ *Ibid.*

company spokesman, “If Boeing is unable to secure sufficient time to prepare a competitive proposal, there is little option for Boeing other than to no-bid.”³¹ Some observers concluded that Boeing’s ploy was intended to threaten a non-competitive source selection that Congress would not tolerate (Weber, 22 August 2008).³²

Just as the Air Force backed down in early 2007 (when NG-EADS threatened a no-bid), the Department of Defense blinked in late 2008 (when Boeing threatened to withdraw from the competition).³³ On September 10, 2008, The DoD announced a postponement to some unspecified time in 2009 (Cole & Lunsford, 2008).

What the rivals will do in the interim has been discussed in the press. Boeing might offer a larger version of the 767, while Airbus might offer a freighter (vs. passenger) version of the A330. It’s also possible that Boeing would offer a 777-based proposal and Airbus the A340 (Epstein, 2008).

In any case, the KC-X program will experience yet another significant delay. Even if a new source selection is concluded in a timely manner, and even if that award survives a likely protest,³⁴ nothing will happen until Congress appropriates the necessary funds. And the Boeing supporters on Capitol Hill might well make strong efforts to prevent that—if NG-EADS wins the new competition. What the NG-EADS Congressional supporters would do if Boeing wins the new competition is a matter

³¹ The Boeing 777 and Airbus A340 are significantly larger aircraft than the 767 and A330 currently in the game. The Airbus A340 seems unlikely given that (a) there’s no A340 freighter readily available, and (b) the A340 has not competed well with the Boeing 777 in the commercial marketplace. Good starting places for more information are the Wikipedia articles on the A340 and Boeing 777.

³² From a Boeing perspective, this seems a reasonable position. The firm had seriously considered offering a 777-based aerial tanker prior to the original competition, but had decided against it—a choice perhaps related to the no-credit provision for extra fuel offload capability in the original RFP. Wallace (2006).

³³ A caveat is in order. We’re relying on press reports as foundation for this statement, which may or may not reflect the essential facts of the matter. Hence, our characterization should be regarded as provisional at this point

³⁴ Appeals to the GAO are necessarily the end of the appeals options for losing bidders. For example, the KC-135 support contract was overturned in federal court after GAO ruling against protests twice. (Shalal-Esa, October 1, 2008).

for more speculation, but nonetheless a difficulty for the new tanker program if it's a Boeing product.³⁵

Observations and Discussion

As noted above, the facts regarding the KC-45 (KC-X) competition have not yet been made fully available to the public. Accordingly, it's best at this time to offer hypotheses as opposed to findings and conclusions. However, we're on secure grounds in concluding that the outcome of the KC-45 competition was not good for the nation, the Air Force, or any of the industrial participants. There are a fair number of hypotheses that seem to fit the observable events, none of which are particularly encouraging. Those hypotheses are posed below as a series of questions.

Are Protests Inevitable?

Defense aircraft purchases have devolved into very few numbers of new types awarded on a winner-take-all basis—with awards that are correspondingly very large and infrequent. In the case of the KC-45, it's likely that the next opportunity to bid for a new aerial tanker will not come for at least 15 years. It's a high-stakes game, with potentially severe consequences for the losers.³⁶

Because the stakes are high, the award protest is accordingly appealing. In this case, the protest has certainly bought sufficient time to fully mobilize Boeing's political support. Given the winner-take-all nature of the KC-45 competition, it's fairly

³⁵ Congress is apparently ready to consider significant changes to the C-27/C-130H mix in tactical transports through the appropriations process. (Tiron, 2008)

³⁶ This was also the case for the Joint Strike Fighter—awarded to Lockheed-Martin over Boeing—in 2001. It's worth noting that there is no other tactical fighter purchase even on the horizon for the US DoD, with worries about the industrial base for fighters recently emerging as a major issue. By contrast, when the US Air Force chose YF-16 (General Dynamics) over the YF-17 (Northrop) in the 1970s, Northrop was able to team with McDonnell-Douglas and succeeded in selling the F-18 (a variant of the YF-17) to the US Navy and to international defense establishments.

easy for the competition to become pure conflict (a zero-sum game).³⁷ In short, there's good reason to believe that losing-bidders' protests will become a major feature of DoD competitions in the current environment.

If so, the increasing numbers of bidding protests observed are more a symptom rather than the real problem. There's no reason, for example, to believe that making protests more difficult or risky (at least to any reasonable degree) will make protests sufficiently less attractive to be pursued significantly less often—given the stakes in the very large, winner-take-all contract awards. Moreover, the perceived effects on the protester's reputation are probably not significant either. Memories fade over the periods of time (decades) between contract awards in the various major system categories

Is a Protest-Proof Source Selection Consistently Achievable?³⁸

Boeing's KC-45 protest took an involved exception to an involved source selection process. After extensive review, the GAO ruled in favor of Boeing. In a July 2008 interview, Michael Wynne (former Secretary of the Air Force) opined that Boeing had, over the course of the competition, withheld information from the Air Force—probably to bolster a protest case should it lose the competition (Bennett, 2008). While Mr. Wynne's statement is (as far as we know) not corroborated, it's difficult to dismiss it as being implausible. Suppose for the sake of argument that the award had gone to Boeing and that the NG-EADS team had protested. Given the same set of facts about the Air Force conduct of the competition, could an NG-EADS protest have also been sustained?³⁹ At this point, the question is clearly

³⁷ If sales were frequently made, it would generally be a better allocation of management attention and resources to take steps to increase chances of making the next sale. However, if sales are separated by decades, then the best use of management resources changes significantly.

³⁸ The question is more precisely, but less briefly, posed using legal terminology as follows: "Is it possible to award a major defense contract without the presence of reversible errors?"

³⁹ This was, after all, a fairly close competition—given the terms of the RFP. To continue our judicial analogy, could the GAO have found reversible errors had the result hypothetically gone in Boeing's favor?

unanswerable, but we're confident that "no" has not yet been established as a reasonable answer to the question. It seems entirely possible that the GAO would, on similar grounds, have denied an award to Boeing —especially if the NG-EADS team had pursued the tactics that Wynne attributed to Boeing. This would, of course, be an interesting question for more study—with sufficient resources and access.

Should we rethink the bargaining strengths of the parties?

The standard model of military contracts (at least up to the award decision) involves competing suppliers facing a sovereign monopsonist. The facts of the matter in the case of the KC-45 were much different. Instead of the government acting as a monopsonist,⁴⁰ something more closely resembling a “quarrelsome committee” has been evident. It appears that major military contracts have become yet another point of contention between the Executive and Legislative branches. A Legislature that trusted the Executive to make sensible contract award decisions would likely not have instituted a means to protest (appeal) the original award and would likely not have designated a Congressionally-affiliated agency (i.e., GAO) as something of an appellate court.

On the supply side, the bidders have exploited the committee's divisions and also their small numbers. The Legislature (one of the major members of the quarrelsome committee) insists upon competition (in part, due to distrusting the Executive) even when there are only two plausible bidders. In that environment, both bidders have a great deal of market power with respect to the source selection agency—based simply on the threat not to respond with a bid to the government solicitation. In early 2007, the NG-EADS team did precisely that and succeeded in changing the rules of the competition. In the Summer of 2008, Boeing made the

⁴⁰ Taken seriously, the “monopsonist” model implies a unitary rational actor.

same threat and succeeded in getting the competition (writ large) indefinitely prolonged.⁴¹

If the KC-45 competition does indeed reflect the state of the defense marketplace, then the standard theoretical models will need some major revisions.

Tentative Recommendations

It seems that there are both near-term and more persistent problems that should be addressed. The near-term problem is to find a way to start recapitalizing the Air Force aerial tanker fleet.

The Near-Term Problem

The KC-45 competition, as currently structured, is essentially a zero-sum game between Boeing and NG-EADS—as well as their political supporters. Moreover, it appears that both sides have considerable power to block an unfavorable outcome. It's time to look for a win-win solution, which means restructuring the problem. One classic means of finding the win-win outcome (or at least an acceptable compromise) is to expand the bargaining space and look for possibilities of side payments. Here are two possibilities.

Why not dual source?⁴² The Department of Defense (reflected recently in a statement by Secretary Gates) is strongly opposed to dual sourcing (Talbot, 2008). This is for the standard reasons: increased development costs, higher unit costs due to lower rates of production, more support and supply chains, higher training costs, etc. However, the standard reasons are applicable only if proceeding with either the KC-767 or the KC-30 is a real possibility. Moreover, the Secretary's reasons do not

⁴¹ The competition is expected to emerge from dormancy and be concluded in 2009. Seems to us that's not a sure thing. The Republican candidate for President has strongly and publicly intervened against Boeing (the leasing initiative) and (probably) for NG-EADS, in early 2007. The Democratic candidate has spoken out against loss of American jobs to foreign competition. Regardless of the winner in November, it will be difficult for the Executive Branch to convince outside observers that a fair competition exists. Cole & Lunsford (22 August and 11 September 2008).

⁴² A possibility also raised recently by Rep. John Murtha (D, PA). (Wallace, September 30, 2008)

factor in the incentives for both sides to be both efficient (and pass savings to the government) and innovative (with the government reaping benefits of increased quality and capability).

The current DoD position might well reflect a failure of analysis—or imagination. Given the circumstances discussed in this report, there’s very good reason to believe that proceeding with only one KC-X is not really an available course of action. A more reasonable list of alternatives is (1) proceeding with a dual-sourced “KC-X” and (2) living indefinitely with the existing fleet (KC-135s and KC-10s). Given that set of available alternatives, dual sourcing seems a very reasonable choice.⁴³

How about an out-of-court settlement? The protest process (along with its political manifestations) has made the KC-45 more a matter of litigation than a standard source selection. That suggests an out-of-court settlement that provides compensation (a side payment) to the losing bidder. If the KC-30 is the chosen aircraft, then a side payment to Boeing might take the following form. Retire the C-5A’s⁴⁴ and replace them one-for-one with C-17s procured with a multi-year contract.⁴⁵

If the KC-767 is chosen, then DoD could pursue buying (the yet undeveloped) Airbus A380 as a new airlifter. In fact, there have been reports of Air Force inquiries into the A380 as a potential airlifter (Trimble, 2007).

⁴³ The “second-best” concept applies to public policy analysis. The second best is a good choice when the first-best is not available. In this case, the first-best courses of action (featuring one KC-X) are not available. In that case, the second-best (dual sourcing) seems worthy of serious consideration.

⁴⁴ This would likely entail curtailing or cancelling C-5A upgrades.

⁴⁵ While a C-17 has less cargo capacity than a C-5, C-17 availability rates would be significantly higher and the Air Force would also receive a number of KC-30s, which the service has touted as being a highly capable airlifter.

The Long-Term Problem

Despite the KC-45 being the first priority for Air Force procurement, and despite aerial tankers being relatively uncomplicated devices (relative to fighters and bombers), the procurement process appears to be in a rather moribund state—with a timely conclusion being relatively problematic at present. This is clearly a horrible outcome—like (say) an aircraft accident—and something to be carefully avoided in the future.

As a matter for further study (when reasonably complete information is available) we recommend a forensic case study of the KC-45 competition. The methodology we propose would more closely resemble a safety (or accident) investigation board than a standard business school case study. The intent would be to (a) determine exactly what happened (a detailed set of findings), (b) why it happened (causal factors, perhaps a complex set), and (c) what to do about it (recommendations).

This seems well worth doing, because (among other things) the public discussion of the KC-45 affair has been simplistic at best: blaming Boeing for a lousy proposal (not true), and then the Air Force for conducting a lousy competition (perhaps true).⁴⁶ There's been a rather unproductive discussion of domestic jobs in a global environment (and in which KC-30 manufacture would have extensive US participation). In fact, there is good reason to believe that the bad results now evident in the KC-45 competition might well be the product of multiple causes and (conceivably) systemic failures. In that context, it's possible that a detailed study of the KC-45 competition might well shed useful light on problems with the US defense acquisition system (in all its aspects), and—more importantly—indicate ways to improve it.

⁴⁶ It's easy to focus on "pilot error" in assigning causes to aircraft accidents. If pilots performed perfectly at all times, there would be very few accidents (despite failures and hazards present). But it's also useful to focus on shaping the operating environment (within reason) to (1) make pilots less prone to error, and (2) lessen the consequences of the irreducible minimum frequency of pilot errors.

Section IV. Foreign Direct Investment in US Defense Industries

Background⁴⁷

This section is designed as a preliminary overview of efforts of foreign firms, principally European, to penetrate the US defense market. The dominance of US defense firms is seen in the recent *DefenseNews* table of the top 100 defense suppliers, world wide (Boessenkool, 2008). Seven of the top 10 are American establishments, which, together with the remaining 36, are distributed among every decile of the table. Nevertheless, the 3 non-American firms among the top 10, EADS, Finmeccanica, and BAE, have been quite successful in selling to the US defense sector, and they have been selected as case studies. Confidential interviews with high level, Washington-based officials were conducted in the spring of 2008 and the highlights of these meetings appear below. Since their experiences were constrained by US laws and regulations dealing with foreign suppliers of defense goods, it was deemed useful to provide readers with a brief review of such rules.

US history is replete with debates concerning the extent to which foreign ownership and/or control of domestic productive assets constitutes a risk to national security. The outbreak of World War I gave new impetus to the issue and after the entry of the US into the conflict in 1917, the Trading With the Enemy Act was passed. Essentially, it gave the President the authority to seize foreign-owned assets. President Woodrow Wilson employed the act in 1917 and 1918 to seize almost all US assets owned by German companies in addition to assets owned by US citizens of German origin. The most important of these assets were in the chemical industry, then viewed as being of strategic importance. Of particular interest is the fact that the US government later sold or otherwise transferred such

⁴⁷ Much of this material comes from the excellent study of Graham and Marchick (2006), Chapters 1 and 2. Our debt to Graham and Marchick is insufficiently acknowledged in the citations following.

assets (including patents) to firms such as DuPont and General Electric. A number of other subsequently important American firms began their growth during the post-war years of the 1920s as a consequence of such transfers of intellectual property. Following the war's end, Congress, largely at the urging of the US Navy, enacted several sector-specific prohibitions on foreign direct investment (FDI) in fields deemed strategic such as radio broadcasting, telecommunications, air transport, shipping, and oil.

President Franklin D. Roosevelt resorted to the same law (TWTE) in 1941, again against enemy-held assets despite the fact that the number of such assets then available in the US was quite small. In the case of Germany, Graham and Marchick (2006) attribute this fact to the poor economic health of Germany during the interwar years and fear among German investors about the security of their investments in the US after the World War I experience. Most enemy-held assets were concentrated in the electrical, pharmaceutical, and chemical sectors. Of interest is the fact that during World War II, the US antitrust laws played a key role in the campaign against foreign company investments in the US. In large measure, this reflected their activities with cartel partners in this country. Foreign direct investment in the US grew slowly during the war and by 1946 reached \$2.5 billion with much of it coming from the UK and Canada. Spurred by European economic recovery during the next several decades, however, between 1956 and 1977, the growth rate increased noticeably at an annual compound rate of approximately 13.5%. During the 1985 -2005 interval, foreign direct investment grew more than 8 times from roughly \$185 billion to nearly \$1.7 trillion. Such rapid growth has been accompanied in some quarters by heightened anxiety over possible national security vulnerability.⁴⁸

⁴⁸ Curiously, the rate of growth of US FDI abroad so far outdistanced the reverse flow during the first two postwar decades that a well-known French author, Jean-Jacques Servan-Schreiber, cautioned against the growing risk of US dominance in his widely-read book, *Le Defi Americain*.

In 1977, Congress had amended the Trading With the Enemy Act of 1917 through passage of the International Emergency Economic Powers Act that imposed some limitations on the President's authority to seize and assume title to foreign-owned assets in the US. The amendment required the President to declare an international emergency according to procedures specified under the National Emergencies Act of 1976 in order to invoke the powers of the Trading With the Enemy Act. The Amendment also specified that while the President could seize foreign-owned assets in the US during a declared national emergency, he could not take title since ownership of such assets would remain in the hands of foreign investors with control over them likely to be returned at the conclusion of such emergency. Aside from the change in the rule concerning the taking of title, the remainder of the Trading With the Enemy Act remained largely unchanged.

Over the years, debate continued over the net effects of FDI in the US. In the late 1970s and early 1980s, administration statements were issued on the subject. A formal policy statement by President Jimmy Carter in 1977 advocated a policy of neutrality concerning FDI into the US and US FDI abroad. At about the same time, there was growing concern over the expanding stock of petrodollars accumulating as a result of widely publicized increases in the price of oil by the Organization of Petroleum Exporting Countries (OPEC) in 1974 and 1977. Alarmists worried that such wealth could lead to the acquisition by OPEC states of important US assets. Congressional hearings in 1979, however, suggested that most FDI in the US was coming from Europe, which served to quiet such fears.

In 1977, Congress passed the Emergency Economic Powers Act, which, as noted above, amended the Trading With the Enemy Act of 1917, but such changes could hardly be seen as tightening regulation of FDI in the US. A Reagan administration policy statement issued in 1983 retained the Carter position but welcomed foreign direct investment that appeared in response to market forces.

The year 1985 saw the start of an international expansion in FDI, reflecting in large measure, a rapid growth in multinational firms and their operations. From 1985

to 2004, the stock of FDI in the US grew more than eight times from approximately \$185 billion to just under \$1.5 trillion. This increase translates into an annual compound growth rate of about 11% over the period. What is often ignored is that this phenomenon was not an isolated event and was slightly slower than the global rate of growth. The growth rate in the US actually slowed after 1985, and in the early years of the 21st century, the growth of US outgoing direct investment exceeded the inflow. By late 2004, the stock of US direct investment abroad was about 1/3 greater than the stock of FDI in the US.

By the late 1980s and early 1990s, FDI had become a major and public source of dispute in the American media and Congress. National security concerns dominated the debate and were highlighted in numerous books, articles, and even films. At the time, fear of technology loss to Japan via the purchase of US firms by Japanese firms was high. In fact, the feared technology loss to Japan did not occur, and the US technological lead grew, largely as a result of the explosion in the information technology-based sector. However, the facts rarely overtake the bold headlines and the 2-minute shocking news clips on television.

Graham and Marchick (2006) hypothesize that by the 1970s, the names of large foreign firms investing in the US such as Shell, Lever Brothers, and Philips Norelco had become familiar in the American marketplace, and with their English names, were often taken by consumers as domestically owned and operated. By the 1980s, however, this situation had changed and there was easy recognition of the foreign names of new investors, particularly from Asia.

This brief historical review reveals that restrictions on FDI in the US have usually occurred in periods of war or other insecurity. Fear of growing Japanese dominance of the American high technology sector and two widely publicized attempted corporate takeovers in the late 1980s prepared the way for new Legislative restrictions on FDI.

The Exon-Florio Amendment

Concern in Congress had been building over increased FDI in the US through the 1980s and it reached a boiling point over two well-publicized takeover attempts: one was the move by Sir James Goldsmith, a famous British corporate raider, to absorb Goodyear Tire and Rubber; the other was an attempt by Fujitsu of Japan to gain an 80% interest in Fairchild, then a large California semiconductor producer. Proposed legislation to block the Fujitsu offer alarmed the Reagan administration that foresaw such action as discouraging foreign investment in general and frustrating its efforts to open the Japanese market to US goods. To ameliorate Congressional pressure, it had the Committee on Foreign Investment in the US (CFIUS) undertake a review into possible security risks associated with the Fairchild deal. CFIUS had been created by Executive Order in 1975 to review any investment which might affect the national interests of the US but it was then only a Presidential advisory organization without authority to undertake substantive actions.

To assuage Congressional unhappiness, the Reagan administration went a step further by having the Justice Department review the proposed transaction under the terms of the Hart-Scott-Rodino Act of 1976, which amended the antitrust laws, principally the Clayton Act, by establishing criteria to be used in the evaluation of proposed mergers. Even though the administration was unlikely to prohibit the merger, Fujitsu retracted the offer to Fairchild with the rationale that “rising political controversy in the United States” made proceeding with the deal undesirable (Alvarez, 1989, p. 62).

Dissatisfaction with the administration’s handling of the Fujitsu-Fairchild case was widespread and Senator James Exon (D-NE) introduced a bill giving the President “discretionary authority to review” and take action against “foreign takeovers, mergers, acquisitions, joint ventures, and licensing agreements”

threatening the national security or “essential commerce of the United States.”⁴⁹ This legislation would provide the President with an alternative to the IEEPA, which required him to declare a national emergency to take action against such threats. Congressman James Florio (D-NJ) introduced a similar bill into the House of Representatives.⁵⁰

The proposed Exon amendment to the Defense Production Act of 1950 encountered significant opposition on grounds that it could block foreign investment that did not threaten national security. Opponents also objected to the “essential commerce” provision, the addition of economic factors among criteria for judging a proposed transaction, and the inclusion of joint ventures and licensing arrangements among proposed transactions for review.

After removal of such objectionable sections including deletion of the Secretary of Commerce from the lead role in administering the act, it was finally passed as an amendment to Section 721 of the Defense Production Act of 1950 via the Omnibus Trade and Competitiveness Act of 1988. The act authorized the President to investigate foreign acquisitions, mergers, takeovers of, or investments in US companies from the viewpoint of national security. The President was also authorized by the amendment to block an acquisition if “there is credible evidence that leads the President to believe that the foreign interest exercising control might take an action that threatens to impair the national security” and if, in the President’s judgment, no other laws provide adequate authority for the protection of the national security in this case.⁵¹

After the passage of the Exon-Florio amendments, the President transferred his initial review and decision-making authority to CFIUS, now chaired by the

⁴⁹ “Statement of Senator Exon, *Foreign Investment, National Security and Essential Commerce Act of 1987*”, HR 3, 100th Congress, 1st Sess. (1987), as cited in Graham and Marchick, *op. cit.*, p.41.

⁵⁰ Graham and Marchick, *ibid.*, p. 42.

⁵¹ *Omnibus Trade Competitiveness Act of 1988*,” as cited in Graham and Marchick, *ibid.*, p. 34, note 4.

Secretary of the Treasury. CFIUS is composed of the Secretaries of Treasury, State, Defense, Commerce, Attorney General, Director of the Office of Management and Budget, United States Trade Representative, Chairman of the Council of Economic Advisers, Director of the Office of Science and Technology Policy, Assistant to the President for National Security Affairs, Assistant to the President for Economic Policy, and since 9/11, Secretary of Homeland Security. CFIUS is authorized to review a transaction filed voluntarily by either party to the transaction or after receipt of an agency notice from one of the committee's members.

The law also provides a timetable for CFIUS reviews: a 30-day review following directly upon receipt of a notice; an investigation interval of 45 days for complex proposals requiring extra time beyond the initial 30-day review; a formal report to the President at the conclusion of the 45-day interval, and a presidential decision no later than 15 days after receipt of the formal report.

In several important areas, however, the statute provides CFIUS with broad discretion. Thus, there is no statute of limitations governing committee authority—it is not time-limited. An investigation can be undertaken despite the prior closure of a transaction. Despite the importance of national security in the wording of the act, that term is never defined, although several criteria are identified for possible use in evaluation of a potential threat. Even here, the committee can go beyond such criteria. On occasion, the committee has reviewed industries outside the narrowly-defined defense sector.

“Foreign control” as used in the act has been variously interpreted. Similarly, the term “credible evidence” has not been narrowly defined. All these facts suggest that CFIUS has considerable leeway in deciding whether a proposed transaction's impact on national security is adequate to warrant a formal inquiry, and, if so, whether the findings support a recommendation for the President to block.

Congressional Attempts to Amend Exon-Florio

Since the passage of the Exon-Florio Amendment⁵² there have been many attempts in Congress to make the law more restrictive. These are reviewed in detail by Graham and Marchick. Such attempts have focused repeatedly on several general areas: economic interests as a CFIUS review factor, the departmental identity of the committee chairmanship, issues of technology transfer, strengthened monitoring, and much expanded Congressional involvement in the administration of the act. Proposals for stronger “buy American” limitations on the DoD’s authority to buy abroad have become widely associated with the names of Congressmen Hunter Douglas (D-CA) and John Murtha (D-PA.). With one exception, such attempts have failed. That exception became the Byrd amendment of 1992 to Exon-Florio.

Once again, a highly publicized transaction aroused widespread public and Congressional concern. In this case, it revolved around a 1992 attempt by the French defense firm Thomson-CSF to buy a controlling interest in the American company LTV Aerospace and Defense Corporation, an international leader in missile technology. To make matters worse, the French government owned 60% of Thomson’s shares and controlled 75% of its voting stock. The controversy surrounding what some saw as an attempt by France to obtain control of an important US defense firm resulted in passage of the Byrd amendment, which most importantly, requires investigation of any attempt by a foreign firm essentially owned or controlled by a foreign government to acquire an American firm. The goal, of course, was to prevent the loss of essential US technology to a foreign government.

Congressional criticism of CFIUS operations has continued, usually sparked by some potentially disturbing transaction. In the post 9/11 environment, such criticism has grown more frequent and heated. In mid-2005, the Chinese firm *Lenovo* succeeded in purchasing the personal computer division of *IBM*. This was

⁵² This section describes the situation as it existed from the passage of the Exon-Florio Amendment in 1988 until adoption of the Foreign Investment and National Security Act in October 2007. The changes introduced by that act are outlined below.

no mean accomplishment given the fact that an economically resurgent China had replaced Japan as a seemingly all-powerful economic competitor in the media and on Capital Hill and after the Chinese National Overseas Oil Company (CNOOC) had felt obliged to abandon its plan to purchase California-based *UNOCAL* due to political opposition in the US.

This outcome was very similar to the end of the effort of *Dubai Ports World*, a company owned and controlled by the government of the United Arab Emirates to take over the management of five US ports, previously run by the British firm, *Peninsular And Oriental Steam Navigation Company* (P&O).⁵³

Opponents of CFIUS in the Congress were strengthened by a critical report on CFIUS by the Government Accountability Office released in late September of 2005.

The main criticisms focused on several points: that Treasury and other agencies take a much too narrow perspective on the definition of national security; that CFIUS is hesitant to open investigations for fear that they would chill foreign investment in the US; that the 30-day time limit for the review of proposed foreign acquisitions of US firms is inadequate to permit a detailed study of their national security consequences; and that the CFIUS member agencies do not agree on the criteria for determining whether a broader investigation is appropriate (GAO, 2005).⁵⁴

During the controversy concerning the Dubai Ports World-P&O case, members of Congress were prodigious in drafting new bills to regulate foreign direct investment—more than 20 were introduced and designed to prevent approval of this particular acquisition, to prevent foreign ownership of essential port operations, or to otherwise amend Exon-Florio. A review of the cases named above indicates the growing politicization of the Exon-Florio procedure.

⁵³ The rather shocking details of how the facts in this case were twisted to make it a “national security” matter are related in Graham and Marchick, *op. cit.*, pp.136-139.

⁵⁴ GAO (2005)

To recognize this trend is not to suggest that Exon-Florio should be considered beyond improvement based upon experience under its terms. Indeed, Graham and Marchick (2006) offer several suggestions to improve its operations: adding protection of critical infrastructure as a factor for CFIUS consideration; establishing security standards for employment of foreigners in sensitive positions; enhancing disclosure of information to Congress; clarifying the standard by which CFIUS determines whether there is “foreign” control; and developing international standards for national security review processes (pp. xxi-xxii).

Exon-Florio is not the only means available to the US government to regulate foreign investment in the defense sector. Perhaps less well-known but not insignificant are the terms included in the Pentagon’s National Industrial Security Program Operating Manual (NISPOM). Created by an executive order in 1995 and subsequently amended in 1997 and 2001, its rules require all DoD contractors to have a facility clearance in order to possess access to classified material or to receive a contract to work with classified materials. Criteria are established to ascertain if US firms that have been cleared or are under consideration for a facility clearance are under “foreign ownership, control, or influence” (FOCI). Interestingly, none of these criteria are adequate by themselves in determining FOCI but they must be evaluated in the aggregate. Its establishment of a 5% level of foreign ownership of voting stock as adequate for concern is more demanding than the corresponding CFIUS level. In general, the NISPOM test for foreign control is broader with far more transactions eligible for consideration than CFIUS regulations (p.160).

Procedures under NISPOM and CFIUS are not dissimilar however. For example, receipt of a voluntary notice by CFIUS of a proposed transaction in which foreign investment in the US defense sector is involved triggers a course of action similar to that required by NISPOM for firms considered under FOCI. The FY1993 National Defense Authorization Act requires the Defense Department to ascertain if the unit being acquired maintains possession of critical defense technology under development or can otherwise be determined to be important to the defense

industrial base. If either situation prevails, the DoD is obliged to assess any associated risk of technology loss, which is then distributed to other CFIUS members.

If such risk is deemed by DoD to be capable of being mitigated, however, it may negotiate protective measures with the parties to the acquisition. Typically, such steps fall into several categories depending on the order of restrictiveness viewed as necessary to prevent unauthorized technology transfer. Four general categories follow:

Board Resolution—Where there is only limited foreign ownership and control, a board resolution may be used to the effect that the foreign shareholder will not obtain voting stock adequate to elect members of the board or otherwise obtain board representation.

Limited Facility Clearance—Such a clearance permits the foreign party access to classified material which is limited to that necessary to perform on a contract involving the parent government with which the US government has reached an industrial security agreement.

Special Security Agreement (SSA) and Security Control Agreement (SCA) — Both these agreement forms require the creation of a subsidiary in which limited participation by the foreign owner is permitted. Typically, such owner sits on a board, a majority of whose members are US citizens, cleared by DoD, with no ties to the foreign investors.

Voting Trust Agreement and Proxy Agreement—Under these two similar Agreements, a foreign investor is obliged to form a separate subsidiary for undertaking classified work with the Pentagon. Through such a subsidiary, foreign shareholders are required to abandon any rights to control, influence or direct activities or provide strategic direction of the subsidiary. Such typical share-holder rights are vested in the hands of American members of the board, all of whom must

be citizens who are qualified for security clearances. Further, their selection is subject to DoD approval. (pp.71-72)

Typically, DoD plays the major role in reaching terms designed to mitigate possible negative effects of foreign control and influence. CFIUS approval of such an acquisition of a US firm requires prior DoD endorsement. Often, foreign companies desirous of acquiring a US defense firm are familiar with the CFIUS process and the Pentagon's rules from previous experience and may confer informally with regulatory authorities in advance of submitting a formal application. Also, under certain circumstances, well-known and trusted foreign defense firms can arrange to receive a blanket special security agreement saving the need to negotiate each new case from scratch.

Evidence suggests that a partial liberalization of controls over foreign direct investment in the US defense sector may have occurred in the late 1990s, but pressures for a reversal of such a development have been building since the events of 9/11 (p. 73). A number of bills were drafted in the Congress during 2006 of a rather extreme nature but none were adopted. Finally, in October 2007, Congress passed the Foreign Investment and National Security Act of 2007 (FINSA).⁵⁵

The following details of FINSA are taken from GovTrack.us (2007). FINSA amended the Defense Production Act of 1950, revising sections dealing with the authority of the President to review certain mergers, acquisitions, and takeovers and requiring the President, through CFIUS, upon receiving formal notification from any parties to such mergers, etc., proposed or pending after August 23, 1988, which might lead to foreign control of any person engaged in a covered transaction, to undertake a review in order to determine its effects on national security.

The President or CFIUS is authorized to investigate any covered transaction, including those previously reviewed if there is reason to believe that any party

⁵⁵ The following details of FINSA are taken from GovTrack.us (2007).

submitted false or misleading information or, if any party intentionally breaches in a material way—a mitigation agreement or condition previously imposed upon the transaction.

CFIUS is required to undertake an immediate inquiry into the effects on national security of certain covered transactions: (1) if it concludes that a threat to national security exists and has not been mitigated, or the transaction is foreign government-controlled; (2) the transaction would lead to control of any US critical infrastructure by a foreign person that would impair national security without proper mitigation; or (3) the lead agency for each covered transaction recommends, with CFIUS concurrence, that an investigation be undertaken. Such inquiry must be completed within 45 days. Investigations of foreign government-controlled transactions, or those involving critical infrastructure will not be required if the Treasury Secretary and the head of the lead agency jointly conclude that the transaction will not harm national security.

The Act further requires the chair of CFIUS: (1) to publish in the Federal Register guidance on the transaction types that CFIUS has considered to raise national security considerations; and (2) and the head of the lead agency to transmit a certified notice and written report covering each investigation of a covered transaction to specified members of Congress. The Director of National Intelligence is also required to conduct an analysis of any threat to national security associated with a covered transaction.

CFIUS, which previously has operated under the authority of an Executive Order, is converted into a multi-agency statutory committee with a revised membership. Thus, the previously named members included the Director of the Office of Management and Budget, the US Trade Representative, the Chair of the Council of Economic Advisers, the Director of the Office of Science and Technology Policy, and the Assistants to the President for National Security Affairs, and Economic Policy. These officials are no longer named, but the Act recognizes the authority of the President to designate the heads of other executive agencies as may

be deemed desirable. Of interest is the specific addition of the Secretaries of Energy and of Labor and the Director of National Intelligence.

Further, an additional post of Assistant Secretary of the Treasury has been established to conduct CFIUS-related duties. In addition, the Treasury Secretary will be required to designate CFIUS member(s) to act as lead agency(ies) to deal with covered transactions.

Additional factors have been specified for the President to consider in evaluating covered transactions. These include whether the proposed transaction: (1) has national security-related consequences on US critical technologies; and (2) is a foreign government-controlled transaction.

The act authorizes CFIUS or a lead agency to reach agreements with parties to a covered transaction to mitigate any threat to national security. The lead agency may negotiate, modify, monitor, and enforce such agreements and must submit periodic reports to CFIUS on implementation of such agreements.

The President is authorized to suspend or prohibit any covered transaction threatening to harm national security and is required to consider specified factors in deciding to suspend or prohibit a covered transaction.

The Act requires CFIUS (1) upon request, to brief certain members of Congress of covered transactions for which action has concluded; and (2) to submit annual reports to Congress after such completed inquiries. CFIUS is also required to report information concerning possible foreign acquisition of US firms engaged in the research, development, or production of critical technologies, as well as possible industrial espionage.

The Secretary of the Treasury is required to (1) annually study foreign direct investment in the US, especially in critical infrastructure and in industries affecting national security by foreign governments (or their agents) that comply with any boycott of Israel or do not ban terrorist groups; and (2) report each study's results to Congress. The Act directs the Inspector General of the Treasury to conduct

investigations of any failure by Treasury to deliver any report required by CFIUS, and to report such investigation results to appropriate Congressional committees.

Despite the surface appearance of a significant tightening in the procedures governing FDI in the US, informal comments by Treasury Department officials suggest that changes will be modest as the act essentially codified practices that were already largely being followed. With respect to the changes in the membership of CFIUS, as noted above, the President retains the authority to name members to serve from his Executive departments as he sees fit. In addition, apparently some of the new members will serve in an ex-officio capacity with limited authority, to ensure that focus remains on issues of national security. Increasing the flow of information to Congress enhances transparency, which was one of the recommendations by Graham and Marchick (2006, pp. 152-156).

After the foregoing review of the legislative and regulatory background, we shall now present three case studies of European firms that have been quite successful in finding ways to penetrate the US defense market.

Three Cases⁵⁶

European Aeronautic Defence and Space Company (EADS)

EADS is Europe's largest aerospace company and, worldwide, ranks second behind Boeing. Its operations focus on civil and military aircraft, space, defense systems, and assorted services. The company emerged in July 2000 from the merger of the activities of DaimlerChrysler Aerospace (DASA) of Germany, Aerospatiale Matra of France, and Construcciones Aeronauticas S.A. (CASA) of Spain. Its statutory headquarters is located in the Netherlands (which causes confusion on lists that identify its nationality as Dutch), but its actual headquarters are divided between Paris and Munich. For much of its early life, British Aerospace

⁵⁶ Valuable contextual information on these three firms is taken from the excellent study by Vlachos-Dengler (2004). At this point we acknowledge a significant debt that's insufficiently documented in the citations following.

Systems (BAe) was a fourth partner, but it sold its interests back to EADS in 2006. For some 30 years earlier, Airbus passenger aircraft were produced in a consortium arrangement in which the partners retained ownership of engineering and production assets leaving Airbus Industrie, *per se*, largely as an organization devoted to sales and marketing. Corporate integration was first proposed in 1989, but was unsuccessful with both governments and firms reluctant to surrender control of their aerospace and defense industries. By the years 2000 and 2001, however, a European wave of aerospace consolidation became irresistible and the modern structure of the company emerged.

EADS ranked seventh, worldwide, in its defense revenues in 2007 of \$12.2 billion. This represented 21.3% of its total revenues that year of \$57.6 billion. This level of defense dependency was next to the bottom of the top 10 producers, largely reflecting the importance of its Airbus market.

EADS' ownership of Airbus has provided much of its profits but also made it vulnerable to fluctuations in the market for civil aircraft. As a consequence, EADS' management determined to increase its presence in military and related markets and, given the relatively low defense budgets of most European countries, the US defense market became an obvious target. Apparently, its top management has concluded that building an industrial presence in the US is necessary to encourage serious interest in its products by American procurement officials. A recent example of this strategy was illustrated by EADS' acquisition in April of 2008 of PlantCML, a California provider of emergency-response systems. Louis Gallois, chief executive of EADS, noted that the acquisition would strengthen the company's position in security systems and, hence, expand its industrial presence in North America (Pearson, 2008, p. B8).

EADS North America's activities fall into six lines of business: aerial refueling tankers, rotorcraft, transport and mission aircraft, defense electronics and systems, test and services, and space.

EADS' strategy has been to use joint ventures and niche products and technologies to attain entree into the US defense market. It has developed close relations with Northrop Grumman in several different sectors, the most important of which is probably their joint effort to win a US Air Force contract to begin the replacement of aging tanker refueling aircraft, a high priority goal of the US Air Force.

Our meeting with EADS-North America officials occurred in the spring of 2008, just prior to the initial Air Force decision to award the contract to the EADS-Northrop Grumman partnership. Hence, much of the conversation focused on that project.

Our respondents began by noting that EADS had brought an established commercial aircraft, the A-330, to the competition, well certified and, off the shelf, as it were, yet more modern and superior to the Boeing 767 entry. They believe that the heart of the USAF decision to compete the project grew out of a leasing scandal and that the introduction of an additional bidder profoundly influenced the intensity of competition. They stressed that there is a widespread under-appreciation of the level of competition likely to evolve in a duopoly situation in which such considerations as price and meeting delivery dates are at issue.

Returning to a specific comparison, our respondents stressed that the Boeing entry has never been flown or tested for the tanker mission. It would be a redesigned 767 with new wings, landing gear, cockpit, control surfaces, and engine—all taken from other aircraft. It has been likened to a Frankenstein creation, like putting a digital cockpit on an analogue plane.⁵⁷

It was stressed that no new commercial 767's have been sold since 2002 and that the new version will have no established history. In contrast, Airbus has been receiving new orders for its A-330 every week. Further, EADS is offering a tested,

⁵⁷ At least from an EADS perspective. On balance, we believe this to be negative campaigning by one party in a highly visible and disputatious source selection.

more modern plane, equipped with a fly-by-wire system. It was claimed that the A-330 refueling system is superior with a bigger envelope for its boom and a faster and safer performance in offloading fuel. Our respondent explained that this results from the fact that fuel storage in the EADS tanker will be located in facilities in the wings and tail, while the Boeing tanker will use fuel bladders for storage. In addition to these qualities are the Airbus's capacity to carry more cargo and troops. It was pointed out that in a wartime scenario, use of the EADS–Northrop product would permit the use of fewer aircraft to accomplish the same mission. It was also noted that in the respondents' opinion, their aircraft represented a tested product versus an untested new design, it was a superior product, already being produced on a robust production line, and already flying. We were also informed that EADS has won the last five international competitions with Boeing, and that Boeing's 767-based tanker has only been selected (and in small numbers at that) by Italy and Japan. Both customers are apparently unhappy with the results, with the Italian Air Force furious at the repeated delays.⁵⁸ It should be noted that the Boeing tankers sold to these two countries are not the same aircraft that Boeing has offered to the USAF in the competition with EADS but an earlier version.

An issue that has been repeatedly raised as an advantage of the Boeing entry is its smaller size, which is assumed to mean that it could more easily operate from rougher fields with shorter runways. The EADS response has been based on two points, one technical and the other operational. The technical point is based on a comparison of the length of runway needed for each aircraft to takeoff in a fully loaded configuration. Our EADS respondent maintained that the EADS tanker (A-330 based) can operate from a 7,000-foot runway in comparison with the Boeing (767 derived) tanker which would require an 8,000-foot runway. He explained this seemingly counterintuitive fact by emphasizing that the wing spread and engine power were more important determinants of runway requirements than size of aircraft. In his view, size related more to available ramp space for loading, while

⁵⁸ For a recent review of the Italian experience, see Kington (2008, p. 1).

conceding that his aircraft would probably require a different system of operations than the present one. On the operational side, he stressed that while refueling other aircraft while airborne, tankers (as well as their “customers”) were in a highly vulnerable position since they fly flat in a straight line and at a constant speed. Hence, they rarely fly unaccompanied by airborne warning and control aircraft and fighter aircraft, which are charged with protecting the tankers. They are viewed as too valuable an investment to fly near areas of fighting, so the ability to land on rough fields with short runways is not seen as a significant advantage. Another related consideration is the fact that such aircraft require very large fuel storage facilities at bases from which they operate and these are located only at major military air bases or very large commercial airports.

EADS plans to build the tanker in an assembly facility located in Mobile, Alabama, which they noted would be the first new such facility built in the US in four decades. Apparently, the decision has also been made to build A-330 commercial freighter aircraft in the same facility. They foresee major economic growth in the region, reasoning that aircraft parts suppliers of all kinds will be drawn by the EADS-Northrop facility. They also expect dramatic improvements in the broad educational environment in the area, having already contacted the University of South Alabama about new and/or expanded programs designed to help provide training for potential employees. If successful, such programs would not only be useful to EADS but also beneficial to the entire region in developing a more capable labor force to attract additional industrial development. EADS also plans to produce the boom in the Mobile facility, while the hose and drogue will be provided by Sargent-Fletcher (a subsidiary of the Cobham company of the UK) at its Bridgeport, West Virginia, plant. EADS also anticipates constructing a facility near the Sargent-Fletcher operation to complete the boom assembly.

Our respondents noted that EADS’ CEO has declared a strategy to expand its footprint in the US, *even independent of the final tanker decision*, since “it’s just good business”. The boardroom belief is that since they are buying so much from the US, it makes sense to create a diversified portfolio here. In subsequent conversations

with an EADS spokesman, the question was raised whether the EADS decision to locate non-tanker work in the US was, in fact, independent of their prior success in winning the USAF tanker competition. We were informed that such an interpretation was incorrect. The printed evidence on the subject is mixed. An article in the *Seattle Post-Intelligencer* in November 2007 noted that as part of its drive to “put an American face” on its bid for the tanker contract, EADS had teamed with Northrop-Grumman and had “promised to build a new factory in Mobile, ALA., *if it wins*” (Rosenberg, 2007). Several other news stories, however, cast doubt on the independence of the two decisions. In particular, reporting on an interview with EADS’ CEO, Louis Gallois, at the Farnborough Air Show in the summer of 2008, a *Wall Street Journal* reporter noted:

As EADS becomes more global, defense is a crucial sector for the company. And with European defense budgets remaining mostly stagnant, that means the company must do more business in the US. Because of that, Mr. Gallois says, EADS and Airbus’s plans for an assembly line in Mobile, Ala. *don’t hinge on their getting the tanker contract.* (Wingfield, 2008, p. A9.)

Whichever interpretation is correct, shortly after the GAO report supporting Boeing’s complaint that the USAF failed to follow proper procedures in awarding the contract to the Northrop-EADS team, the planned groundbreaking ceremonies scheduled for Mobile were cancelled.

Perhaps more important than this issue of conditionality is the matter of domestic content. Students of the “offset” phenomenon in defense trade would probably use this term to characterize the above debate. When posed with this question of definition, an EADS official responded that “You can call it offsets if you like” and then after hinting that the issue might be dismissed as mere semantics, went on to indicate why domestic content was part of the EADS business plan for locating manufacturing and assembly work in the US. He identified three reasons:

- They believe that the US taxpayer has the right to expect a domestic return for his government’s decision to purchase a foreign product.
- EADS benefits because of the Euro-dollar exchange rate.

- A political factor is present since the product purchased from abroad must contain 51% American content. Beyond that, however, to support the project long term, they need a political as well as an industrial presence in the US.

The partnership details with Northrop-Grumman have been carefully prepared to meet national security regulations concerning foreign firms working on US defense projects in this country. Northrop will be responsible for integrating all electronic warfare systems, military avionics, and modifying all refueling sets. Its facilities will be collocated in Mobile and, as it was put, the security firewall would be constituted by the runway. US technology would be carefully protected with even strict limits on what the engineers from the two partners could discuss. Checks and balances from the US International Traffic in Arms Regulations (ITAR) will be strictly enforced, and we were assured that EADS' personnel were quite familiar from their work in other countries with similar regulations that were described as quite commonplace now. When Special Security Agreements have been reached they will establish boundaries limiting access by non-citizens to secure areas. Part of the company's Board of Directors will consist of US citizens, and foreign owners will be largely limited to receiving profit payments, without any access to critical technologies. Thus, EADS-North America will be a US-based independent operation, functioning under an independent oversight board.

Finally, it was stressed that globalization has advanced much further than even informed citizens are aware, and that such concepts as the nationality of a product are quite imprecise. It was pointed out, for example, that US sources are the largest contributors of parts for the Airbus A-330, and that while Boeing is not among such suppliers, EADS and Boeing share many suppliers. In the above cited interview, EADS CEO Louis Gallois argued that EADS' "purely European" identity is no more. He insisted that "We are not European, [...] we are becoming global. As they [Boeing] are global. Because their [tanker] has parts made in Japan, in China, in Korea, in Italy... Their airplane is global, our airplane is global, and we are living in that world... And I think Boeing could understand that" (Wingfield, 2008, p. A9).

That level of sophistication is rare in the ongoing debate. Senators Patty Murray and Maria Cantwell of Washington have argued strongly that the EADS-Northrop entry in the tanker competition is a “foreign” aircraft. In Murray’s words, “Airbus has shown its true colors time and again, and they’re anything but red, white, and blue” (Mundy, 2005).⁵⁹ At the time of this writing, Secretary of Defense Robert Gates had dropped plans to select one of the two tanker proposals during the remainder of the Bush presidency.

Finmeccanica/Alenia

The Finmeccanica group is Italy’s largest, and in 2007 ranked as Europe’s third largest defense company with revenues from defense activities of \$10.6 billion. This compares with \$3.9 billion in 2002, a growth of 2.7 times in 5 years. (The figures are in current dollars). While its rank, worldwide, remained unchanged at ninth in 2006 and 2007, its dependence on defense revenues grew from 48% in 2002 to 53.6% in 2007. Originally owned by the Italian state holding company, Istituto per la Ricostruzione Industriale (IRI), Finmeccanica was converted into the Italian national champion for defense in the 1989-1995 period. By 1997, the company was in serious financial difficulties, and under new management, was converted from a conglomerate to a financial holding company concerned with developing and managing trans-European programs in defense and aerospace. This was accomplished by the formation of joint companies with international partners. Yet later, Finmeccanica was again transformed from a financial holding company into an industrial group in its own right. It now employs approximately 65,000 persons worldwide, and its activities focus on advanced aerospace, defense, homeland security, communications, energy, transportation, helicopters, radar systems, UAV, and underwater systems.

Since its restructuring, Finmeccanica has adopted an industrial strategy based on international alliances and partnerships. Several years ago, it was

⁵⁹ It might be noted in passing that the famous tricolor flag of France is, indeed, red, white, and blue.

estimated that such alliances accounted for some 80% of its aerospace and defense revenues (Vlachos-Dengler, 2004, p. 47). Such ventures were designed, in part, to compensate for the organization's lack of critical mass required to serve as prime contractor in its core activities.

At the international level, Alenia has participated in the Eurofighter Typhoon program, the trinational Tornado multirole combat aircraft, the AMX tactical support and reconnaissance aircraft with Embraer of Brazil (partnered with Alenia's Aermacchi), the ATR42MP, a maritime patrol application of the ATR42 commuter aircraft, and with Airbus, on the A400M airlifter.

In the US, Alenia has successfully competed for the US 101 Presidential helicopter, via its Agusta-Westland Helicopter division (partnered with Lockheed Martin), and the C27J Spartan Joint Cargo Aircraft for the US Army and Air Force (partnered with L-3 Communications, and Boeing). It is the major Italian industrial partner on the F-35 Joint Strike Fighter and a partner with Boeing on the new 787 Dreamliner. Alenia also hopes to interest the US Air Force and Navy in the Alenia-Aermacchi M346 advanced jet trainer.

In the words of the President and CEO of Alenia North America:

It is our goal to become a real American company within the framework of our parent company. We want to have our own independent industrial and technical capability through our joint ventures. Our company will generate revenues and profit for our shareholders and will help to achieve Finmeccanica's strategic target of expanding its presence in the US market. Alenia North America is in the process of establishing a defense company under Alenia NA, with a Special Security Agreement that will allow us to further expand our business in the US military market. (Giordo, 2007, pp. 16-17)

Satisfying US security requirements will be somewhat complicated because of the role of the Italian state in Finmeccanica's operations. While this role has been reduced somewhat by the dismantling of IRI in 2000 and the company's privatization, the Italian government retains a 25-30% stake in the company and at

least one representative on the board of directors. Its partnership on a regional jetliner with Sukhoi of Russia may also be troublesome.

Our respondents conceded that they have a captive market at home, but noted that Italian defense spending is so low, that, in order to survive and grow, they have to seek alternative markets abroad. However, they decided against structurally joining Airbus or EADS.

Of interest were the observations made that compared winning contracts in Europe with winning in the US. For example, the role of offsets was described as crucial in the European market. By way of contrast, their experience in the US suggests that product quality dominates the decision making. In addition, past performance is all important, especially in winning the role of prime contractor. It was emphasized that to do business in the US, a foreign firm must collaborate with a US prime to insure domestic content,⁶⁰ and also, if possible, introduce new technology. The British Harrier would appear to be a good example.

Our respondents noted that despite their successes with the Presidential helicopter and the C27J joint cargo aircraft, Alenia was not yet ready to win a contract in the role of prime contractor in the US. This was due, in part, to their failure, thus far, in obtaining a sufficiently large industrial position. They see their role as providing niche products while collaborating with their US partners. In response to a question asking them to identify their major American competitors, they provided the interesting answer that they currently see other European-based firms, such as EADS, as their principal competition. They are continuously searching out their best strategic alliances such as Lockheed Martin on the Joint Striker Fighter and Boeing on the 787 Dreamliner. However, they emphasized that they are not interested in a *general* alliance and prefer to treat each program separately.

⁶⁰ A "strict constructionist" might point out the similarity of the term "domestic content" to "offset."

The American practice of having Congress act on budget matters annually was seen by our respondents as emphasizing the importance of remaining on good terms with its members. Decision on the location of facilities within the US was seen as an effective and legal way to accomplish that goal. Finmeccanica and Alenia appear to have learned that lesson well. A rough count of the location of Finmeccanica facilities in the US reveals 17 states. Alenia, by itself accounts for 9, excluding the District of Columbia. Perhaps this might be interpreted as a micro-application of their vision of Italy playing a role as a bridge between Europe and the US. In the spring of 2008, Finmeccanica employed more than 1,200 persons in their US facilities, a figure which they expect to reach 2,000 in the near future.

Their preference is to grow “organically” or from the ground up rather than via acquisition of other defense firms. However, their attempt to acquire the US firm, DRS Technologies, Inc., revealed in May of 2008, appears at variance with that preference. A press analysis of that deal stressed the new attractiveness of such high technology firms to larger defense conglomerates, in part, because of the soaring demand for their advanced products, and the fact that such products don’t require the huge capital investments associated with the production of such “big ticket” items as aircraft, ships, and tanks (Michaels, 2008, p. B3; Nativi & Butler, 2008, pp. 40-41).

Of particular interest were comments by a high-ranking Alenia executive concerning the more recent successes of European firms in competition with their US counterparts. Three factors were emphasized:

- European firms have more experience in international competition resulting from their necessity to seek markets abroad due to the relatively small size of their domestic defense budgets.
- The advancing age of US defense engineers and the declining rate at which their replacements are being trained has created a significant problem for the US. Our respondent put the average age of Lockheed’s engineers at 54.
- The procurement processes of other nations are less bureaucratic than those of the US.

He also stressed the difference in business plans between US and European firms, emphasizing the cash flow orientation of American firms, which requires a faster payoff schedule and a short run orientation, hence a higher price. Another factor which may be weakening US firms' ability to compete is the heavy role played by the US government in the sale of its military products. Examples given were the essentially non-competitive nature of the international sales of such aircraft as the F-15, F-16, and the JSF, which our respondent saw as sold by the US government as a political phenomenon.

The captive US market for American firms may also be weakening their ability to compete internationally. An example was given of the C-130 military transport. Boeing had a monopoly of the domestic market. When the time came to be competitive, US firms had forgotten how to compete and were not very successful. Our respondent saw a serious risk of loss of market by American firms. In his opinion, they must learn to rely on more than World Trade Organization (WTO) appeals. When coupled with these potential weaknesses of US firms, foreign competitors may find a bright future in supplying certain niche areas of the US defense market.

Our respondent complained of widespread lack of understanding in the US of the regulations detailing the responsibilities of foreign suppliers to the US defense establishment. Bilateral Memoranda of Understanding (MOUs) for example, treat foreign suppliers as if they were US suppliers. Foreign suppliers generally are successful in preventing politics from intruding into their contractual obligations. Italian firms may be headquartered in Rome, but they must act as if they were a global enterprise. Finmeccanica's shares may be traded on the Milan stock exchange, but 30 to 40% of those shares are owned by institutional investors from the US. He complained of a failure to understand the importance of both foreign investors and foreign customers. For example, the reluctance to permit foreign buyers to acquire the new US F-22 Raptor aircraft have hurt as the expected domestic orders from the DoD have not been realized. His view was that US politicians have very little appreciation of the important role played by exports and by

foreign partners in significant American projects. As he put it, “Buy American laws are bad for the US, bad for US forces, and bad for US firms.”⁶¹

To be successful, in his view, competing firms must offer the best products and this requires that they understand what the customer wants. He turned his attention, momentarily, to the now famous aerial refueling tanker competition, and gave his opinion that if the originally successful EADS-Northrop proposal was rejected, the global market reaction would be negative and foreign countries might reconsider doing business with the US in the military marketplace.

With respect to the Italian experience on the Eurofighter project, Italy was quite satisfied with the *juste retour* arrangement that managed industrial participation. He felt that much of value was learned dealing with the management of technology and people. As his group moved from earlier models such as the AMX and the ATR to military jets, much of the experience moved with them, and the Eurofighter was a critical experience in the application of composite technology to the next generation of military aircraft. Now, his group is confident that they have the ability to perform well on such advanced aircraft as the JSF and the 787 Dreamliner.

With respect to the JSF, he noted that Alenia was not satisfied with its access to all advanced technology. He emphasized that more than building the airplane was involved and questions of whether it would fly well must also be considered. Matters of operational sovereignty were paramount and it was critical that Finmeccanica fully understand how to maintain the aircraft during its useful life. He noted that in a sense, electronics was a “sacred cow” and that in this area the US government had not gone far enough to satisfy the needs of the partner companies. He was unhappy with ITAR regulations dealing with technology transfer and third

⁶¹ This statement is part of the Finmeccanica-Alenia interview held in the Washington area in the Spring of 2008. The interviewees were guaranteed confidentiality and a promise of non-attribution.

country sales, and expressed the view that all partners were not treated equally. In his opinion, the UK is being favored. On matters of work share on the JSF, Alenia is relatively satisfied and feels that Lockheed understands the wants and needs of its partners.

In response to our question, the respondent noted that Finmeccanica did not face much competition within Italian industry in its work on the JSF nor did he see evidence that non-traditional industries were involved in the project. He made the interesting observation that there was more competition *within* Finmeccanica as to which division would get the work

Also of interest was his observation that politics played a much larger role on the Eurofighter project than on the JSF, in which the best quality seems to determine who does what. He also singled out with satisfaction the fact that Italy was involved from the very beginning of the project in system design issues. Italy is responsible for the center wing box and serves as a second source on final assembly and as follow-on supplier.

BAE Systems

BAE Systems of the UK is, by far, the largest European defense producer, ranking third globally with defense revenues of \$29.8 billion in 2007, a gain of 18.7% from its 2006 figure. Its 2007 revenue from defense sales represented 95.0% of its total revenue (Boessenkool, 2008, p. 12). It clearly dominates the UK defense market. Its North American market, its largest, has grown rapidly in recent years, increasing from 34% of sales in 2002 to approximately 50% in 2007. Much of this gain was associated with its acquisition of two major US producers of armored products (United Defense and Armor Holdings) in a time of high demand for such items.

In response to a question in a recent interview, asking whether BAE will, in 5 years, resemble its present form, Walter P. Havenstein, President and CEO of BAE Systems, Inc. (BAE's US subsidiary) replied:

I'd be surprised if you didn't see a company that looked quite different [because] the growth opportunities will invariably move around. Before 9/11 (2001)[...] BAE Systems did not have a global land systems business. We do today. So I would be surprised if some other inflection point didn't occur during the next five years that would cause us to shift. And I think that's one of the things that BAE Systems has been able to do fairly well. Think about what we did in just the last 18 months: the acquisition of United Defense, creating a global land and armament systems business, and exiting Airbus. We've made some fairly strong moves. (Velocci and Anselmo, pp. 68-69)

After its earlier acquisition of Britain's Alvis, and the US- based United Defense and Armor Holdings, BAE has surpassed General Dynamics as the world's largest producer of military vehicles. Before the acquisition of Armor Holdings, BAE was primarily a builder of tracked armored vehicles. Armor Holdings manufactures the High Mobility Multipurpose Wheeled Vehicle and a family of heavy-and medium-weight tactical trucks acquired after its recent purchase of Stewart & Stevenson. This permits BAE to satisfy the demand for tactical vehicles emerging from the intersection of needs for armored combat vehicles and their support vehicles (Chuter & Muradian, 2007, p. 1). A BAE Systems company publication describes it as "the premier global defence and aerospace company, delivering a full range of products and services for air, land and naval forces, as well as advanced electronics, information technology solutions and customer support services."

It might also be noted that by its acquisitions, BAE has not only diversified to meet the needs of all military services, but also positioned itself to be an important supplier of both traditional high technology systems as well as equipment needed for asymmetric, guerrilla style combat.⁶²

In the above-noted interview, Walter P. Havenstein, President and CEO of BAE's US subsidiary stressed the importance of in-house R&D spending. In answer to a question, he observed:

⁶² It might be noted also that as a result of such acquisitions, BAE has not only obtained capital assets but prime contractor responsibilities as well.

I've got a whole bunch of Skunk Works. [Across the US] we have several innovation centers, some fairly sophisticated modeling and simulation labs, a networking lab. All those labs are connected. So the idea is to be able to create a Skunk Works in a virtual sense [...] Our land and armaments business has what we call dome simulators, and probably the next thing on our agenda is to start integrating these simulation centers across our operating groups.

BAE's efforts to introduce its research results into its products is illustrated by the work of its Electronics & Integrated Solutions operating group whose headquarters are located in Nashua, New Hampshire. According to E&IS President Michael A. Heffron, his group has focused on "recapitalization" that involves changing parts or adding new capabilities incorporating the latest technology without changing any of the existing functions. This is usually cheaper than replacing an entire existing system with a new one. Current open architecture computer systems permit the rewriting of software for the latest platforms capable of more rapid information processing that often adds new capabilities. An example of this process is E&IS's success in developing a new computer processor for the ALE-47 countermeasures dispenser that increases processing speed and boosts memory by a factor of eight, permitting the system to deal with the latest threats. The ALE-47 device was recently estimated to be carried by 3,000 aircraft flown by the US and its allies, suggesting a sizeable potential market (Hughes, 2007, pp. 68-69).

Our interview began with the BAE respondent stressing how important the US subsidiary had become in the total operations of the parent company. Apparently, both the parent company and the US elements have won important contracts in the US. In addition to the armor work stressed above, BAE has a major role in the production plan for the Joint Strike Fighter, being responsible for providing the center fuselage. Hundreds of BAE engineers are employed in the US for this project. BAE is providing 17% of the content of the JSF. He also reminded us of other accomplishments of BAE in the US, such as its partnership with Boeing on the Harrier, and its provision of heads up display units to many US airlines. It is also acting as partner with Textron on a light weight artillery piece.

Vlachos-Dengler (2004, p. 20) has noted how difficult it would be for a foreign firm to obtain prime contractor responsibilities on an American defense contract.⁶³ Nevertheless, our respondent indicated his belief that BAE might be approaching such an opportunity, given its successes in recent years. They understand the implications of the 51% domestic requirements in DoD contracting and have “played by the book.” We were told that BAE had responded to 56 separate requests for quotes and had never lodged a protest about the outcomes. In her above-cited work, Vlachos-Dengler (2004) quoted the comment of a senior BAE official to the effect that “the only way to effectively enter the US defense market is to become a US company.”⁶⁴ Apparently BAE has found a way to accomplish this.

It appears that the acquisition of successful American defense firms has been the favored method. However, such acquisitions have not always been easily absorbed. Our respondent stressed that the key to successfully absorbing another firm is the recognition of the difficult cultural shift involved in such a transaction. He emphasized that “from day one, the new employees are carefully treated as members of the BAE team” with major efforts to avoid the sense that two distinct classes of employees are present, the new ones and the veterans. All are provided with BAE badges, signs, and phones. The goal is to bring about a fit, both culturally and technically, to facilitate BAE’s investment in the technical skills of the acquired company.

Our respondent noted that to introduce a product into the US, it was necessary to focus on creating jobs and not in the abstract. In other words, you must specify where those jobs would be located. This solidifies the promise of a favorable economic impact and increases the probability of success. It also would be helpful to invite an American partner to assume the role of prime contractor. BAE is not trying to integrate horizontally.

⁶³ *Op.cit.*, note 27, p.20.

⁶⁴ *Op. cit.*, note 25, p. 20.

BAE's decision to acquire another firm is, of course, dependent on what that firm appears to offer and, on occasion, an earlier acquisition by the target firm strengthens its attractiveness. An example was given of GE Marconi which had acquired Tracor in 1998 for \$1.4 billion. Tracor's headquarters were in Austin, Texas, and it had a strong position in information systems, electronic warfare, and other avionics, making it a promising candidate for acquisition. Marconi was absorbed by BAE in the 2000.

When it comes to special security protection, BAE Systems faces the same requirements as any other foreign firm. They have a Special Security Agreement that provides access to classified US Government programs. To be eligible to bid, win, and work on contracts involving classified information, they are guided by the National Industrial Security Program Operating Manual, and must prove compliance with the Arms Export Control and Export Administration Acts. Among other things, they have a Special Board of Directors consisting of seven distinguished US citizens. Our respondent indicated that the company was proud of the stature of its special board that includes three retired 4-star generals, one each from the US Army, Air Force and Marine Corps, a retired full admiral of the US Navy, a former Deputy Director of Central Intelligence, a former Undersecretary of State for Security, Science, and Technology, and a former distinguished member of Congress. We were also told that this board provides BAE with a shield, as it were, to help it appear like an American company with no extraordinary risk of technology loss to a foreign country. Despite the emphasis on growth through acquisition, it was pointed out that BAE had also experienced some organic growth as well.

In an organization structured like BAE, an interesting question arises as to how work is divided between the parent company in the UK and its various subsidiaries located abroad. An example is provided by its participation in the Joint Strike Fighter project. BAE is responsible for providing 1/3 of the fuselage of the aircraft. The parent company bears this responsibility and delivers its product to Fort Worth stuffed with all necessary parts and equipment. An important component consists of electronics, which are provided by a unit of BAE North America. This

division of labor reflects the fact that so-called “metal bending” work is done by BAE facilities in the UK while the US unit has specialized in electronics work. Intra-corporate coordination is obviously an important challenge.

Our respondent reported satisfaction with the UK’s participation in design and access to technology on the JSF project. However, the issue of operational sovereignty was a matter of concern when it came to Britain’s capacity to modify the systems of its aircraft in times of war without US permission or participation. Like other representatives of the British government and industry with whom we have discussed the issue, our respondent appeared quite satisfied with the agreement reached between US representatives and Lord Drayson, the former British procurement chief. It would be well to remember the caveat of a responsible Lockheed executive, however, who cautioned that the proof will be in the pudding—in this case, watching the operation of the agreement on a case-by-case basis.

Our respondent also expressed amazement at the behavior of several members of Congress, who, in their efforts to defend the interests of constituent industry, behaved like they were really representatives of the company rather than of their individual constituents. It sounded to us as if he were wondering about a possible redefinition of the term “public interest.” On the other hand, he expressed a high level of admiration for the professional acumen of the force acquisition community in the Defense Department.

Concluding Thoughts on the Cases

At the conclusion of this examination of the experience of foreign firms in penetrating the US defense market, several generalizations emerge. They may be grouped in three areas. First, why do foreign firms desire to penetrate the US defense market? The answers may appear obvious, but their importance varies from case to case. A factor that is present almost across the board is the relatively low level of domestic defense spending for military procurement outside the US. When married to the almost universal desire to maintain at least some minimum essential level of domestic competence in defense industry, participation in the

export market becomes essential. The quality challenges required to meet high standards demanded by US procurement officials provide a spur to foreign firms with a desire to sell to the DoD. Technology acquisition resulting from work with experienced and high quality US partners is also a welcome potential advantage. The reputation for high quality standards demanded by the US military spills over as an advantage to firms able to meet such standards and improves their own reputations for quality work. Last, but certainly, not unimportant, are profit opportunities associated with long production runs, rarely found outside the United States.

A second area deals with the obstacles found by foreign firms attempting to sell to the DoD. Again, these are well known, but certainly not impenetrable as proved by the successes of firms like the three examined above. First, is the level of domestic protectionism encountered in the US Congress. Foreign critics often cite the “Buy American” Acts, but innovative foreign firms with a desire to sell in the US have found ways to circumvent the most extreme application of these laws. It should also be noted that the US did not invent Buy National legislation, so dramatic *mea culpas* are probably unnecessary. Perhaps more difficult to overcome are long-standing relationships at the personal level between US industry and the DoD. On the other hand, the Pentagon has gradually acquired a respectable list of European defense products that has strengthened the level of transatlantic cooperation.⁶⁵ The US export control regime remains another obstacle but, again, not an impenetrable one.

One might also look for lessons to be learned from the successful experience of EADS (despite the frustrating fight over the aerial refueling tanker case), Finmeccanica/Alenia, and BAE. It would appear that locating facilities in the US, preferably teaming with an American firm, is a potentially significant advantage. Offering a superior product is an obvious necessity but not just any product. Firms

⁶⁵ For an interesting discussion of this issue, see the editorial entitled “Europe’s Turn To Open Up” that appeared in *Aviation Week*, March 17, 2008, p. 82.

that have been able to provide a superior product occupying a particular niche and performing an important function, which, for whatever reason, American firms have largely ignored, have a real advantage.

Finally, recent experiences such as those related above, may be casting new light on the old argument of a two-way street in defense trade between the US and Europe, or, rather, its absence. A more contemporary view of such trade may show more progress in this area than may have been anticipated in the past.

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Section V. Concluding Thoughts

As noted, this report continues our inquiry into global defense industrial base. As among other things, we've acquired a firm grasp of the obvious: defense industrial affairs are becoming increasingly international and increasingly complex. While the trend is certainly not new, we may well be approaching some qualitative changes in the nature of this complicated system.

The complexity and cost of modern military acquisition projects are fundamentally changing the nature of economies of scale. Production runs that can exploit available economies of scale and learning curves are increasingly beyond the means of single nations. Furthermore, the risks entailed by these projects have become matters of grave concern for even the largest prime contractors.⁶⁶

This has been reflected on both the supply and demand sides of the defense marketplace. Increasingly, new weapon systems (such as the Joint Strike Fighter) have become international ventures—albeit with senior partners. On the supply side, defense industrial firms have undertaken, for a number of reasons, projects through outsourcing arrangements, risk-sharing consortia, and strategic partnerships. In addition, the number of first-tier firms has steadily declined.⁶⁷

It's reasonably safe to conclude that inter-firm relationships are more a product of context and project than by the firm boundaries of more traditional thought. Thus, major industrial firms (such as Boeing and Lockheed-Martin) can compete in some areas (e.g., tactical fighters) and cooperate in others (e.g., the next-generation US bomber). The predictable result has been the increasing complexities and management difficulties associated with major projects. Boeing's problems with the Dreamliner are instructive for defense market players, even though the 787 is a commercial project.

⁶⁶ The difficulty has less to do with the requisite number of units and more with the unit costs.

⁶⁷ The markets for major defense systems are apparently becoming natural oligopolies.

Given the increasing complexity of defense enterprises, it's not surprising to predict that a small number of first-tier suppliers have attained increasing market power with respect to their government customers. While market structure certainly matters, it also appears that relatively agile, opportunistic defense suppliers can simply outclass their bureaucratic customers. As Section IV demonstrates, government regulations cannot create impenetrable barriers to firms in search of profits—through mergers, acquisition and “organic” direct investment across national borders. The KC-45 affair seems a clear demonstration of the suppliers’ increased power. There is reason to believe that suppliers not only influence the terms of the competition, but they can, on occasion, dictate them. The NG-EADS threat to withdraw from the KC-45 competition (2007) followed by the Boeing threat to do the same (2008) illustrate this point. In both cases, it appears both firms got (basically) what they wanted. Other defense suppliers have no doubt observed the results.

There seem to be at least two problems for the sovereign buyers to solve in the defense marketplace. First, institutions and regulations (such as export control regimes) probably need thorough reconsideration. The failure to successfully select a new Air Force tanker (yet) indicates strongly the need to adapt defense acquisition institutions to the new global defense environment. Likely, those institutions need to become more adaptive to a rapidly changing military environment as well a changing defense marketplace.

The second problem is becoming and remaining a knowledgeable customer.⁶⁸ We believe this means taking better care of the human capital accounts in the defense work force and formulating intelligent strategies for managing increasingly complex military systems (and systems of systems) throughout very long life spans.

⁶⁸ Yet another useful idea to emerge from the UK Defense Industrial Strategy.

List of References

- Airbus 330. (2008). Wikipedia. http://en.wikipedia.org/wiki/Airbus_A330
- Airbus A340. (2008). Wikipedia.
http://en.wikipedia.org/w/index.php?title=Airbus_A340&oldid=240415840
- Alvarez, Jose E. (1989). Political protectionism and United States international investments obligation in conflict: The Hazards of Exon-Florio. *Virginia Journal of International Law*, 30(1).
- Anselmo, J. C. (2008, April 21). Inside the 787 meltdown. *Aviation Week & Space Technology*, 158(16), 41-42. Retrieved June 8, 2008, from ProQuest.
- Associated Press (2008, July 9). US reopening \$35 billion aerial tanker bidding, <http://www.msnbc.msn.com/id/25607574/>
- Associated Press (2008, August 11) Boeing, Northrop meet pentagon on \$35B tanker deal. Retrieved Month, day, year, from <http://www.iht.com/bin/printfriendly.php?id=15186162>
- Avery, S. (2007, October 18). At Boeing, supplier collaboration takes off. *Purchasing*, 136(13), 44. Retrieved May 26, 2008, from ProQuest.
- Aviation Week (2008, January 28), Commercial Aircraft, Aerospace Source Book, pp. 72-81.
- Aviation Week. (2008, May 21). Land grab: BAE systems' new US chief broadens push into land systems, while dismissing talk of a mega-merger. *Aviation Week*, pp., 68-69.
- Beauchair, N. (2007, Winter). Supply chains under strain. *Interavia*, 690, 9-12. Retrieved May 26, 2008, from ProQuest.
- Bennett, J. T. (2008, July 10). Wynne: Boeing withheld info during tanker competition. *DefenseNews*. <http://www.defensenews.com/story?i=3620611>
- Boeing. (2008, March 11). Boeing protests US air force tanker contract Award. News Release. Retrieved http://www.boeing.com/ids/news/2008/q1/080311b_nr.html
- Boeing. (2008, May). Boeing 787 Dreamliner: Product Information. Retrieved May 26, 2008, from <http://www.boeing.com>
- Boeing 767. (2008). Wikipedia. http://en.wikipedia.org/wiki/Boeing_767

- Boeing 777. (2008). Wikipedia.
http://en.wikipedia.org/w/index.php?title=Special:Cite&page=Boeing_777&id=239807816
- Boessenkool, A. (2008, August 4). Unlocking new markets: Top 100 firms see acquisition, adjacent sales as key to growth. *DefenseNews*, 11-14.
- Butler, A. (2008, August 15). Pentagon runs tanker meetings over weekend..
<http://www.aviationweek.com/aw/generic/story.jsp?id=news/WEEK08158.xml&headline=Pentagon%20Runs%20Tanker%20Meetings%20Over%20Weekend&channel=defense>
- Butler, A. & Fulghum, D.A. Hometown Hubris? (2008, March 10). *Aviation Week*, 20-22.
- C-5, U.S. Air Force Fact Sheet, April 2008
http://www.af.mil/factsheets/factsheet_print.asp?fsID=84&
- C-17 GLOBEMASTER III, AIR FORCE FACT SHEET, MAY 2008,
<http://www.af.mil/factsheets/factsheet.asp?fsID=86>
- Chuter, A. & Muradian, V. (2007, May 14). As BAE bulks up, US firms worry. *DefenseNews*, p. 1.
- C-5. (2008). Wikipedia. <http://en.wikipedia.org/wiki/C-5>
- C-17 Globemaster III. (2008). Wikipedia. http://en.wikipedia.org/wiki/C-17_Globemaster_III
- Cole, A. (2008, March 12), Boeing files formal protest of tanker award. *Wall Street Journal*, p. B2.
- Cole, A. & Lunsford, J. L. (2008, September 11). Boeing gets reprieve in fuel-tanker contest, B1 http://online.wsj.com/article_print/SB122105210879619199.html
- Crown, J., & Epstein, K. (2008, March 11). Boeing's audacious allies. *Business Week Online*. Retrieved June 3, 2008, from EBSCOhost.
- Defense Science Board. (2004). *Task force report on aerial refueling requirements*, Washington, DC:
- Demisch, W. (2006, July 17). ITAR's end. *Aviation Week & Space Technology*, 165(3), 108. Retrieved June 8, 2008, from EBSCOhost.
- Epstein, K., & Crown, J. (2008, May 24). Globalization bites Boeing: The flap over the loss of a big contract to EADS ignores the planemaker's dependence on foreign suppliers. *Business Week*,. Retrieved May 26, 2008, from ProQuest.

- Epstein, K. (2008, August 28). Boeing's tanker challenges mount. *Business Week*.
http://www.businessweek.com/bwdaily/dnflash/content/aug2008/db20080828_900773.htm?chan=rss_topStories_ssi_5
- Franck, R., Lewis, I., & Udis, B. (2008). *Echoes across the Pond: Understanding EU-US defense industrial relationships* (NPS-AM-08-002). Monterey, CA: Naval Postgraduate School.
- Giordo, G. (2007). The secret to success in the US: An interview with Giuseppe Giordo. *Finmeccanica North America Magazine*, (1),16-17.
- Government Accountability Office (GAO). (2005, September) *Defense trade enhancement to the implementation of Exon-Florio could strengthen the law's effectiveness* (GAO-05-686). Washington, DC:,Author.
- Government Accountability Office (GAO). (2006). Stronger practices needed to improve DoD technology transition processes (GAO-06-883). Retrieved June 8, 2008, from <http://www.gao.gov>
- Government Accountability Office (GAO). (2008a). Decision, matter of: The Boeing company (Decision).. Washington, DC: Author.
- Government Accountability Office (GAO). (2008b) Statement Regarding the Bid Protest Decision Resolving the Aerial Refueling Tanker Protest by The Boeing Company. (Statement). Washington, DC: Author.
- Government Accountability (GAO). (2008c). Defense acquisitions: Assessments of selected weapons programs (GAO-08-467SP). Retrieved June 8, 2008 from, <http://www.gao.gov>
- GovTrack.US.. (2007). Foreign investment and national security act of 2007, H.R. 556—110th Congress.
- Graham, E. M., & Marchick, D. M. (2006, May) *US national security and foreign direct investment*. Washington, DC: Institute for International Economics.
- Gillie, J. (2008, June 3). Airplanes sell, so Boeing hires 875 workers. *The News-Tribune* (Tacoma, WA). Retrieved June 3, 2008 from <http://www.thenewstribune.com>
- Global Security.org. (ND). 463L pallet cargo system. Retrieved September 1, 2008, from <http://www.globalsecurity.org/military/systems/aircraft/463L-pallet.htm>
- Global Security.org (undated, 2008) KC-X Boeing Protest, Retrieved September 9, 2008, from <http://www.globalsecurity.org/military/systems/aircraft/kc-x-protest.htm>

- Gravois, J. (2006, April 14). Mob rule. *Chronicle of Higher Education*, <http://chronicle.com/weekly/v52/i32/32a01001.htm>
- Herszenhorn, D. & Bailey, J. (2008, March 10). In tanker bid, it was Boeing vs. bold ideas. *New York Times*, http://www.nytimes.com/2008/03/10/business/worldbusiness/10tanker.htm?_r=1&scp=1&sq=Boeing%20vs.%20Bold%20Ideas&st=cse&oref=slogin
- Hughes, D. (2007). Replace, refurbish, recapitalize, *Aviation Week*, 29 October 29, pp. 68-69.
- Keating, E. G., & Dixon, M. (2003). Investigating optimal replacement of aging air force systems. Santa Monica, CA: RAND.
- Kennedy, Michael, et. al. (2006). Analysis of alternatives (AoA) for KC-135 recapitalization (Summary). Santa Monica, CA: RAND.
- Knight, William et. al. (2008). *Air Force refueling: The KC-X aircraft acquisition program*. Washington, DC: Congressional Research Service.
- Kushner, A.B. (2008, March 17). Why US Airlines can't compete; America has a high-tech economy, but its carriers are weighed down by old planes and stifling rules. *Newsweek* (International Ed.), 151(11). Retrieved June 3, 2008, from ProQuest.
- Jane's. (2008, February 20). The Boeing company: Boeing 787 Dreamliner. Retrieved May 26, 2008, from Jane's Online.
- Kington, T. (2008, September 8). Delivery of Italy's tankers slips to '09. *DefenseNews*, p. 1.
- Liker, J.K. (2003). *The Toyota way*. New York: McGraw-Hill.
- Matlack, C. (2008, April 28). What Airbus learned from the Dreamliner: As the planemaker finalizes its superlight A350, it's also paying close attention to Boeing's mistakes. *Business Week*, 4081, p. 92. Retrieved May 26, 2008, from ProQuest.
- Meckler, L. (2006, April 5). Politics & economics: Senate panel bids to block new rule on airline control. *The Wall Street Journal* (Eastern Edition), p. A6. Retrieved June 3, 2008, from ProQuest.
- Michaels, D. (2008, May 12). Finmeccanica Targets US Defense Firm. *Wall Street Journal*, p. B-3.
- Michaels, D. & Cole, A. (2008, March 5). Pentagon embattled over tanker decision, *Wall Street Journal*, p. 12.

- Moad, J. (2007, June). Boeing's big supply chain wager. *Manufacturing Automation*, 22(5), 23-28.
- Mundy, A. (2005, June 23). Southern charm in Alabama pick by EADS, *Seattle Times*,
<http://community.seattletimes.nwsources.com/archive/?date=20050623&slug=tanker23>
- Nativi, A. & Butler, A. (2008, August 11). American agenda: DRS acquisition, JCA deal come into focus for Finmeccanica. *Aviation Week*, pp. 40-41
- Norris, R., & Wall, G. (2008, May 18). Boeing goes back to drawing board for 737 follow-on. *Aviation Week & Space Technology*. Retrieved June 9, 2008, from <http://aviationweek.com>
- Northrop Grumman. (2008, February 18) KC-30 Tanker is 20 percent more capable according to US Air Force evaluation model. News Release.
http://www.irconnect.com/noc/press/pages/news_releases.html?d=136532
- Northrop Grumman (2008, April 23 to June 12) Why We Won ..., a series of press releases, entire series available at
http://www.northropgrumman.com/kc45/media_center/archive.html.
- Northrop Grumman (2008, June 19) Northrop Grumman Defers Mobile, Alabama Groundbreaking Event, Media Advisory,
<http://www.northropgrumman.com/media>
- O'Sullivan, A. (2006). Why tense, unstable, and diverse relations are inherent in co-designing with suppliers: An aerospace case study. *Industrial and Corporate Change*, 15(2), 221-250.
- Pearson, D. (2008, April 23). EADS Is buying US firm for \$350 Million, *Wall Street Journal*, <http://online.wsj.com/article/SB120887333925934643.html>.
- Rosenberg, E. (2007, November 16). In tanker bid, airbus ducks its French roots. *Seattle Post-Intelligence*,.
- Sabbagh, K. (1996). Twenty-first-century jet: The making and marketing of the Boeing 777. New York: Scribner.
- Servan-Schreiber, J. (1967), *Le Defi Americain*. New York: Atheneum.
- Shalal-Esa, A. (2008, August 6). Pentagon revives tanker contest. *Reuters*.
http://biz.yahoo.com/rb/080806/usa_tanker.html
- _____, (2008, 1 October) UPDATE 2-Alabama Aircraft wins suit on tanker maintenance, *Reuters*
<http://www.reuters.com/article/marketsNews/idUSN0150874920081001>

- Sharma, K.J., & Bowonder, B. (2004). The making of *Boeing 777*: A case study in concurrent engineering. *International Journal of Manufacturing Technology and Management*, 6(3-4), 254-264.
- Shiibashi, K., & Perrett, B. (2007, July 30). Stealth play. *Aviation Week & Space Technology*, 167(5), 22-23. Retrieved June 8, 2008, from EBSCOhost.
- Smock, D. (2007, June 4). The Dreamliner: A materials revolution. *Design News*. Retrieved May 26, 2008, from <http://www.designnews.com>
- Talbot, G. (2008, 24 September). Gates against tanker split, Al.com http://blog.al.com/live/2008/09/gates_against_tanker_split.html
- Thompson, L. B. (2008, March 3). *Tanker competition: Northrop won by a wide margin*. Issue Brief. Washington, DC: Lexington Institute,.
- Tiron, Roxana (2008, September 17), Lockheed hopeful of cargo plane deal, THE HILL.COM,
- Tran, P. (2007). Dassault, EADS may build more aircraft outside euro zone, *DefenseNews*, 9 (10 December) http://infoweb.newsbank.com/iw-search/we/InfoWeb?p_product=AFNB&p_theme=aggregated5&p_action=doc&p_docid=11D9F1838AC533C0&p_docnum=1&p_queryname=3
- Trimble, S. (2007). US consider Airbus A380 as Air Force One and potentially a C-5 replacement, *Flight International*, 17 October, <http://www.flightglobal.com/articles/2007/10/17/218681/exclusive-us-considers-airbus-a380-as-air-force-one-and-potentially-a-c-5-replacement.html>
- Vlachos-Dengler, K. (2004). *Off track? The future of the european defense industry*, Santa Monica, CA: RAND Corporation, National Defense Research Institute.
- Wallace, James (2006) Aerospace Notebook: Boeing now offers the 777 as a tanker Seattle Post-Intelligencer, 27 September, http://seattlepi.nwsourc.com/business/286576_air27.html
- Wallace, J., (2008, September 30) Aerospace Notebook: How about splitting the tanker award? Seattle Post-Intelligencer, http://seattlepi.nwsourc.com/business/381228_air01.html
- Wingfield, K. (2008). European tankers for the US Air Force? Sacre Bleu! *The Wall Street Journal*, 2-3 August, 2008, p. A9
- Weber, J. & Epstein, K. (2008, 22 August). Boeing's game: Bid or no bid? *Business Week*, http://www.businessweek.com/bwdaily/dnflash/content/aug2008/db20080822_725647.htm

Wilson, J.R. (2008, May). Chasing a Dreamliner. *Aerospace America Online*. Retrieved May 26, 2008, from <http://www.aiaa.org/aerospace/Archives.cfm?ArchiveIssueid=100>

Zumbrun, J. (2008, June 3). Fly the aging skies. *Forbes.com*. Retrieved June 3, 2008, from <http://www.forbes.com>

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